

Table 1. Rate constant for hydrogen molecule in  $v=0$  and  $J=0-5$  states. "2.9050 -29" means  $2.9050 \times 10^{-29}$ .

T(K)	$v=0, J=0$	$v=0, J=1$	$v=0, J=2$	$v=0, J=3$	$v=0, J=4$	$v=0, J=5$
100	---	---	---	---	---	---
200	---	---	---	---	---	---
300	---	---	---	---	---	---
400	---	---	---	---	---	---
500	---	---	---	---	---	---
600	---	---	---	---	---	---
700	---	---	---	---	---	---
800	---	---	---	---	---	---
900	---	---	---	---	---	---
1000	---	---	---	---	---	1.3898 -29
1100	2.9050 -29	3.5147 -29	5.1973 -29	9.3909 -29	2.0303 -28	5.2986 -28
1200	7.2548 -28	8.6698 -28	1.2497 -27	2.1720 -27	4.4655 -27	1.0947 -26
1300	1.0988 -26	1.2995 -26	1.8330 -26	3.0829 -26	6.0740 -26	1.4122 -25
1400	1.1238 -25	1.3172 -25	1.8237 -25	2.9823 -25	5.6651 -25	1.2586 -24
1500	8.3964 -25	9.7653 -25	1.3306 -24	2.1233 -24	3.9078 -24	8.3464 -24
1600	4.8620 -24	5.6164 -24	7.5456 -24	1.1787 -23	2.1100 -23	4.3539 -23
1700	2.2826 -23	2.6211 -23	3.4779 -23	5.3312 -23	9.3133 -23	1.8641 -22
1800	8.9990 -23	1.0278 -22	1.3488 -22	2.0333 -22	3.4756 -22	6.7709 -22
1900	3.0627 -22	3.4815 -22	4.5239 -22	6.7178 -22	1.1262 -21	2.1415 -21
2000	9.2003 -22	1.0413 -21	1.3411 -21	1.9648 -21	3.2367 -21	6.0218 -21
2100	2.4834 -21	2.7999 -21	3.5772 -21	5.1770 -21	8.3940 -21	1.5312 -20
2200	6.1124 -21	6.8672 -21	8.7094 -21	1.2465 -20	1.9922 -20	3.5693 -20
2300	1.3885 -20	1.5549 -20	1.9589 -20	2.7754 -20	4.3776 -20	7.7155 -20
2400	2.9406 -20	3.2833 -20	4.1111 -20	5.7705 -20	8.9926 -20	1.5613 -19
2500	5.8552 -20	6.5199 -20	8.1177 -20	1.1297 -19	1.7411 -19	2.9813 -19
2600	1.1040 -19	1.2263 -19	1.5189 -19	2.0971 -19	3.1990 -19	5.4083 -19
2700	1.9834 -19	2.1979 -19	2.7092 -19	3.7133 -19	5.6108 -19	9.3740 -19
2800	3.4125 -19	3.7734 -19	4.6305 -19	6.3037 -19	9.4411 -19	1.5601 -18
2900	5.6487 -19	6.2335 -19	7.6175 -19	1.0304 -18	1.5307 -18	2.5036 -18
3000	9.0305 -19	9.9467 -19	1.2108 -18	1.6282 -18	2.4002 -18	3.8883 -18
3100	1.3991 -18	1.5383 -18	1.8657 -18	2.4951 -18	3.6518 -18	5.8633 -18
3200	2.1068 -18	2.3127 -18	2.7954 -18	3.7190 -18	5.4065 -18	8.6081 -18
3300	3.0918 -18	3.3886 -18	4.0827 -18	5.4053 -18	7.8083 -18	1.2335 -17
3400	4.4317 -18	4.8501 -18	5.8259 -18	7.6779 -18	1.1025 -17	1.7288 -17
3500	6.2173 -18	6.7950 -18	8.1388 -18	1.0680 -17	1.5250 -17	2.3745 -17
3600	8.5524 -18	9.3349 -18	1.1151 -17	1.4573 -17	2.0699 -17	3.2016 -17
3700	1.1554 -17	1.2596 -17	1.5008 -17	1.9537 -17	2.7611 -17	4.2442 -17
3800	1.5352 -17	1.6716 -17	1.9870 -17	2.5772 -17	3.6249 -17	5.5390 -17
3900	2.0088 -17	2.1849 -17	2.5911 -17	3.3491 -17	4.6894 -17	7.1254 -17
4000	2.5915 -17	2.8158 -17	3.3320 -17	4.2925 -17	5.9847 -17	9.0449 -17

Table 1. (continued)

T(K)	v=0, J=0	v=0, J=1	v=0, J=2	v=0, J=3	v=0, J=4	v=0, J=5
4100	3.2997 -17	3.5817 -17	4.2296 -17	5.4317 -17	7.5421 -17	1.1341 -16
4200	4.1506 -17	4.5010 -17	5.3048 -17	6.7921 -17	9.3944 -17	1.4058 -16
4300	5.1623 -17	5.5931 -17	6.5794 -17	8.4000 -17	1.1575 -16	1.7242 -16
4400	6.3534 -17	6.8775 -17	8.0759 -17	1.0283 -16	1.4119 -16	2.0938 -16
4500	7.7429 -17	8.3747 -17	9.8171 -17	1.2467 -16	1.7061 -16	2.5194 -16
4600	9.3502 -17	1.0105 -16	1.1826 -16	1.4981 -16	2.0435 -16	3.0055 -16
4700	1.1195 -16	1.2090 -16	1.4126 -16	1.7852 -16	2.4276 -16	3.5566 -16
4800	1.3296 -16	1.4349 -16	1.6741 -16	2.1107 -16	2.8618 -16	4.1771 -16
4900	1.5674 -16	1.6903 -16	1.9692 -16	2.4774 -16	3.3493 -16	4.8714 -16
5000	1.8346 -16	1.9771 -16	2.3002 -16	2.8877 -16	3.8934 -16	5.6435 -16
5500	3.6758 -16	3.9495 -16	4.5665 -16	5.6793 -16	7.5642 -16	1.0798 -15
6000	6.4987 -16	6.9652 -16	8.0119 -16	9.8864 -16	1.3034 -15	1.8372 -15
6500	1.0441 -15	1.1167 -15	1.2789 -15	1.5677 -15	2.0491 -15	2.8574 -15
7000	1.5568 -15	1.6620 -15	1.8964 -15	2.3113 -15	2.9988 -15	4.1433 -15
7500	2.1874 -15	2.3316 -15	2.6517 -15	3.2160 -15	4.1459 -15	5.6824 -15
8000	2.9296 -15	3.1184 -15	3.5364 -15	4.2706 -15	5.4744 -15	7.4509 -15
8500	3.7727 -15	4.0110 -15	4.5373 -15	5.4583 -15	6.9623 -15	9.4174 -15
9000	4.7033 -15	4.9951 -15	5.6378 -15	6.7592 -15	8.5837 -15	1.1547 -14
9500	5.7066 -15	6.0547 -15	6.8202 -15	8.1520 -15	1.0312 -14	1.3803 -14
10000	6.7672 -15	7.1738 -15	8.0662 -15	9.6149 -15	1.2119 -14	1.6150 -14
11000	9.0014 -15	9.5279 -15	1.0680 -14	1.2670 -14	1.5872 -14	2.0990 -14
12000	1.1299 -14	1.1945 -14	1.3354 -14	1.5780 -14	1.9667 -14	2.5842 -14
13000	1.3573 -14	1.4334 -14	1.5990 -14	1.8833 -14	2.3369 -14	3.0539 -14
14000	1.5762 -14	1.6630 -14	1.8517 -14	2.1746 -14	2.6883 -14	3.4969 -14
15000	1.7822 -14	1.8789 -14	2.0886 -14	2.4468 -14	3.0151 -14	3.9061 -14
16000	1.9727 -14	2.0783 -14	2.3070 -14	2.6968 -14	3.3137 -14	4.2778 -14
17000	2.1464 -14	2.2599 -14	2.5054 -14	2.9230 -14	3.5828 -14	4.6107 -14
18000	2.3027 -14	2.4232 -14	2.6835 -14	3.1254 -14	3.8223 -14	4.9053 -14
19000	2.4420 -14	2.5685 -14	2.8415 -14	3.3044 -14	4.0331 -14	5.1630 -14
20000	2.5647 -14	2.6964 -14	2.9802 -14	3.4610 -14	4.2167 -14	5.3859 -14
21000	2.6718 -14	2.8079 -14	3.1009 -14	3.5967 -14	4.3749 -14	5.5767 -14
22000	2.7643 -14	2.9041 -14	3.2048 -14	3.7129 -14	4.5096 -14	5.7378 -14
23000	2.8434 -14	2.9862 -14	3.2932 -14	3.8113 -14	4.6230 -14	5.8721 -14
24000	2.9102 -14	3.0554 -14	3.3674 -14	3.8936 -14	4.7169 -14	5.9821 -14
25000	2.9658 -14	3.1129 -14	3.4288 -14	3.9611 -14	4.7932 -14	6.0703 -14
26000	3.0112 -14	3.1598 -14	3.4786 -14	4.0154 -14	4.8539 -14	6.1390 -14
27000	3.0476 -14	3.1972 -14	3.5181 -14	4.0579 -14	4.9005 -14	6.1904 -14
28000	3.0758 -14	3.2261 -14	3.5482 -14	4.0898 -14	4.9345 -14	6.2264 -14
29000	3.0966 -14	3.2473 -14	3.5700 -14	4.1123 -14	4.9575 -14	6.2488 -14
30000	3.1109 -14	3.2617 -14	3.5844 -14	4.1264 -14	4.9706 -14	6.2591 -14

Table 2. Rate constant for hydrogen molecule in  $v=0$  and  $J=6-11$  states.

T(K)	$v=0, J=6$	$v=0, J=7$	$v=0, J=8$	$v=0, J=9$	$v=0, J=10$	$v=0, J=11$
100	---	---	---	---	---	---
200	---	---	---	---	---	---
300	---	---	---	---	---	---
400	---	---	---	---	---	---
500	---	---	---	---	---	---
600	---	---	---	---	---	---
700	---	---	---	---	---	---
800	---	---	---	---	---	7.6352 -29
900	---	---	1.5329 -29	1.0110 -28	7.7246 -28	6.9017 -27
1000	4.7153 -29	1.9089 -28	9.1400 -28	5.1750 -27	3.3564 -26	2.5133 -25
1100	1.6453 -27	6.0191 -27	2.5737 -26	1.2861 -25	7.2947 -25	4.7273 -24
1200	3.1572 -26	1.0615 -25	4.1305 -25	1.8599 -24	9.4336 -24	5.4196 -23
1300	3.8261 -25	1.1977 -24	4.3028 -24	1.7740 -23	8.1858 -23	4.2470 -22
1400	3.2320 -24	9.5161 -24	3.1927 -23	1.2205 -22	5.1928 -22	2.4687 -21
1500	2.0460 -23	5.7125 -23	1.8062 -22	6.4665 -22	2.5645 -21	1.1302 -20
1600	1.0247 -22	2.7312 -22	8.1986 -22	2.7717 -21	1.0335 -20	4.2629 -20
1700	4.2327 -22	1.0828 -21	3.1048 -21	9.9779 -21	3.5239 -20	1.3708 -19
1800	1.4891 -21	3.6729 -21	1.0111 -20	3.1064 -20	1.0453 -19	3.8603 -19
1900	4.5770 -21	1.0927 -20	2.9003 -20	8.5584 -20	2.7581 -19	9.7218 -19
2000	1.2543 -20	2.9078 -20	7.4689 -20	2.1255 -19	6.5880 -19	2.2268 -18
2100	3.1160 -20	7.0338 -20	1.7538 -19	4.8296 -19	1.4451 -18	4.7029 -18
2200	7.1115 -20	1.5669 -19	3.8028 -19	1.0164 -18	2.9453 -18	9.2600 -18
2300	1.5078 -19	3.2497 -19	7.6944 -19	2.0012 -18	5.6316 -18	1.7156 -17
2400	2.9975 -19	6.3308 -19	1.4654 -18	3.7172 -18	1.0183 -17	3.0140 -17
2500	5.6311 -19	1.1673 -18	2.6464 -18	6.5600 -18	1.7533 -17	5.0529 -17
2600	1.0062 -18	2.0503 -18	4.5595 -18	1.1065 -17	2.8905 -17	8.1284 -17
2700	1.7199 -18	3.4490 -18	7.5346 -18	1.7928 -17	4.5854 -17	1.2605 -16
2800	2.8254 -18	5.5827 -18	1.1996 -17	2.8025 -17	7.0286 -17	1.8917 -16
2900	4.4798 -18	8.7301 -18	1.8472 -17	4.2426 -17	1.0447 -16	2.7570 -16
3000	6.8795 -18	1.3235 -17	2.7604 -17	6.2399 -17	1.5106 -16	3.9138 -16
3100	1.0265 -17	1.9511 -17	4.0149 -17	8.9417 -17	2.1303 -16	5.4253 -16
3200	1.4922 -17	2.8044 -17	5.6983 -17	1.2515 -16	2.9372 -16	7.3607 -16
3300	2.1183 -17	3.9392 -17	7.9096 -17	1.7145 -16	3.9675 -16	9.7933 -16
3400	2.9431 -17	5.4183 -17	1.0759 -16	2.3035 -16	5.2602 -16	1.2800 -15
3500	4.0091 -17	7.3117 -17	1.4366 -16	3.0401 -16	6.8561 -16	1.6461 -15
3600	5.3636 -17	9.6952 -17	1.8860 -16	3.9475 -16	8.7978 -16	2.0856 -15
3700	7.0579 -17	1.2651 -16	2.4379 -16	5.0497 -16	1.1129 -15	2.6066 -15
3800	9.1468 -17	1.6264 -16	3.1064 -16	6.3712 -16	1.3893 -15	3.2172 -15
3900	1.1689 -16	2.0627 -16	3.9064 -16	7.9372 -16	1.7135 -15	3.9252 -15
4000	1.4744 -16	2.5832 -16	4.8529 -16	9.7729 -16	2.0897 -15	4.7380 -15

Table 2. (continued)

T(K)	v=0, J=6	v=0, J=7	v=0, J=8	v=0, J=9	v=0, J=10	v=0, J=11
4100	1.8376 -16	3.1975 -16	5.9611 -16	1.1903 -15	2.5222 -15	5.6629 -15
4200	2.2648 -16	3.9152 -16	7.2461 -16	1.4353 -15	3.0149 -15	6.7065 -15
4300	2.7626 -16	4.7461 -16	8.7228 -16	1.7145 -15	3.5719 -15	7.8751 -15
4400	3.3375 -16	5.6996 -16	1.0406 -15	2.0304 -15	4.1966 -15	9.1742 -15
4500	3.9959 -16	6.7853 -16	1.2310 -15	2.3850 -15	4.8925 -15	1.0609 -14
4600	4.7442 -16	8.0122 -16	1.4447 -15	2.7804 -15	5.6625 -15	1.2184 -14
4700	5.5885 -16	9.3891 -16	1.6832 -15	3.2185 -15	6.5095 -15	1.3903 -14
4800	6.5350 -16	1.0924 -15	1.9475 -15	3.7010 -15	7.4359 -15	1.5768 -14
4900	7.5892 -16	1.2626 -15	2.2388 -15	4.2295 -15	8.4438 -15	1.7784 -14
5000	8.7566 -16	1.4501 -15	2.5581 -15	4.8053 -15	9.5350 -15	1.9950 -14
5500	1.6457 -15	2.6699 -15	4.6031 -15	8.4300 -15	1.6278 -14	3.3075 -14
6000	2.7582 -15	4.3989 -15	7.4401 -15	1.3340 -14	2.5179 -14	4.9927 -14
6500	4.2356 -15	6.6577 -15	1.1079 -14	1.9512 -14	3.6125 -14	7.0163 -14
7000	6.0751 -15	9.4307 -15	1.5477 -14	2.6840 -14	4.8876 -14	9.3257 -14
7500	8.2533 -15	1.2674 -14	2.0550 -14	3.5164 -14	6.3123 -14	1.1859 -13
8000	1.0733 -14	1.6326 -14	2.6192 -14	4.4297 -14	7.8522 -14	1.4555 -13
8500	1.3466 -14	2.0314 -14	3.2287 -14	5.4042 -14	9.4737 -14	1.7352 -13
9000	1.6404 -14	2.4562 -14	3.8715 -14	6.4207 -14	1.1145 -13	2.0197 -13
9500	1.9495 -14	2.8996 -14	4.5364 -14	7.4617 -14	1.2837 -13	2.3044 -13
10000	2.2690 -14	3.3547 -14	5.2133 -14	8.5115 -14	1.4527 -13	2.5854 -13
11000	2.9223 -14	4.2758 -14	6.5680 -14	1.0586 -13	1.7821 -13	3.1249 -13
12000	3.5707 -14	5.1794 -14	7.8791 -14	1.2564 -13	2.0907 -13	3.6210 -13
13000	4.1928 -14	6.0372 -14	9.1090 -14	1.4394 -13	2.3719 -13	4.0651 -13
14000	4.7745 -14	6.8317 -14	1.0235 -13	1.6048 -13	2.6223 -13	4.4540 -13
15000	5.3078 -14	7.5532 -14	1.1247 -13	1.7515 -13	2.8414 -13	4.7884 -13
16000	5.7885 -14	8.1980 -14	1.2142 -13	1.8797 -13	3.0299 -13	5.0712 -13
17000	6.2160 -14	8.7662 -14	1.2922 -13	1.9900 -13	3.1896 -13	5.3065 -13
18000	6.5914 -14	9.2606 -14	1.3594 -13	2.0836 -13	3.3231 -13	5.4987 -13
19000	6.9173 -14	9.6857 -14	1.4164 -13	2.1620 -13	3.4326 -13	5.6527 -13
20000	7.1968 -14	1.0047 -13	1.4642 -13	2.2266 -13	3.5208 -13	5.7728 -13
21000	7.4338 -14	1.0349 -13	1.5036 -13	2.2787 -13	3.5901 -13	5.8632 -13
22000	7.6319 -14	1.0598 -13	1.5355 -13	2.3199 -13	3.6427 -13	5.9280 -13
23000	7.7949 -14	1.0800 -13	1.5607 -13	2.3513 -13	3.6808 -13	5.9704 -13
24000	7.9264 -14	1.0959 -13	1.5800 -13	2.3742 -13	3.7063 -13	5.9937 -13
25000	8.0297 -14	1.1080 -13	1.5941 -13	2.3896 -13	3.7207 -13	6.0004 -13
26000	8.1080 -14	1.1168 -13	1.6035 -13	2.3984 -13	3.7257 -13	5.9931 -13
27000	8.1641 -14	1.1227 -13	1.6090 -13	2.4017 -13	3.7225 -13	5.9738 -13
28000	8.2005 -14	1.1260 -13	1.6109 -13	2.4000 -13	3.7123 -13	5.9444 -13
29000	8.2197 -14	1.1270 -13	1.6098 -13	2.3941 -13	3.6961 -13	5.9064 -13
30000	8.2238 -14	1.1261 -13	1.6060 -13	2.3845 -13	3.6748 -13	5.8611 -13

Table 3. Rate constant for hydrogen molecule in  $v=0$  and  $J=12-17$  states.

T(K)	$v=0, J=12$	$v=0, J=13$	$v=0, J=14$	$v=0, J=15$	$v=0, J=16$	$v=0, J=17$
100	---	---	---	---	---	---
200	---	---	---	---	---	---
300	---	---	---	---	---	---
400	---	---	---	---	---	---
500	---	---	---	---	---	2.0037 -28
600	---	---	---	1.1467 -28	5.0848 -27	2.5842 -25
700	---	8.0515 -29	1.8593 -27	4.8337 -26	1.3489 -24	4.2366 -23
800	9.7845 -28	1.4450 -26	2.4007 -25	4.4397 -24	8.7541 -23	1.9166 -21
900	7.0086 -26	8.1012 -25	1.0418 -23	1.4782 -22	2.2247 -21	3.6789 -20
1000	2.1187 -24	2.0129 -23	2.1090 -22	2.4207 -21	2.9353 -20	3.8779 -19
1100	3.4218 -23	2.7689 -22	2.4534 -21	2.3675 -20	2.4056 -19	2.6449 -18
1200	3.4551 -22	2.4457 -21	1.8846 -20	1.5737 -19	1.3799 -18	1.3020 -17
1300	2.4316 -21	1.5369 -20	1.0523 -19	7.7746 -19	6.0183 -18	4.9887 -17
1400	1.2890 -20	7.3933 -20	4.5742 -19	3.0430 -18	2.1168 -17	1.5704 -16
1500	5.4483 -20	2.8727 -19	1.6279 -18	9.8879 -18	6.2697 -17	4.2249 -16
1600	1.9161 -19	9.3853 -19	4.9252 -18	2.7627 -17	1.6153 -16	1.0007 -15
1700	5.7931 -19	2.6588 -18	1.3038 -17	6.8171 -17	3.7107 -16	2.1343 -15
1800	1.5442 -18	6.6892 -18	3.0882 -17	1.5170 -16	7.7484 -16	4.1722 -15
1900	3.7026 -18	1.5230 -17	6.6619 -17	3.0945 -16	1.4932 -15	7.5791 -15
2000	8.1143 -18	3.1856 -17	1.3274 -16	5.8634 -16	2.6879 -15	1.2938 -14
2100	1.6465 -17	6.1968 -17	2.4711 -16	1.0430 -15	4.5644 -15	2.0939 -14
2200	3.1260 -17	1.1323 -16	4.3384 -16	1.7568 -15	7.3710 -15	3.2368 -14
2300	5.6025 -17	1.9594 -16	7.2385 -16	2.8223 -15	1.1395 -14	4.8080 -14
2400	9.5468 -17	3.2333 -16	1.1552 -15	4.3506 -15	1.6955 -14	6.8974 -14
2500	1.5563 -16	5.1172 -16	1.7728 -15	6.4671 -15	2.4398 -14	9.5967 -14
2600	2.4395 -16	7.8054 -16	2.6282 -15	9.3095 -15	3.4084 -14	1.2996 -13
2700	3.6933 -16	1.1522 -15	3.7788 -15	1.3025 -14	4.6380 -14	1.7184 -13
2800	5.4207 -16	1.6518 -15	5.2866 -15	1.7766 -14	6.1651 -14	2.2239 -13
2900	7.7381 -16	2.3070 -15	7.2172 -15	2.3688 -14	8.0250 -14	2.8238 -13
3000	1.0774 -15	3.1471 -15	9.6383 -15	3.0945 -14	1.0251 -13	3.5243 -13
3100	1.4667 -15	4.2031 -15	1.2619 -14	3.9688 -14	1.2874 -13	4.3310 -13
3200	1.9563 -15	5.5067 -15	1.6227 -14	5.0060 -14	1.5922 -13	5.2484 -13
3300	2.5616 -15	7.0900 -15	2.0530 -14	6.2193 -14	1.9419 -13	6.2797 -13
3400	3.2982 -15	8.9850 -15	2.5591 -14	7.6211 -14	2.3385 -13	7.4273 -13
3500	4.1816 -15	1.1223 -14	3.1470 -14	9.2221 -14	2.7837 -13	8.6924 -13
3600	5.2276 -15	1.3833 -14	3.8224 -14	1.1032 -13	3.2788 -13	1.0075 -12
3700	6.4513 -15	1.6844 -14	4.5901 -14	1.3058 -13	3.8245 -13	1.1575 -12
3800	7.8674 -15	2.0283 -14	5.4548 -14	1.5308 -13	4.4214 -13	1.3191 -12
3900	9.4898 -15	2.4173 -14	6.4202 -14	1.7785 -13	5.0695 -13	1.4919 -12
4000	1.1331 -14	2.8536 -14	7.4894 -14	2.0493 -13	5.7686 -13	1.6758 -12

Table 3. (continued)

T(K)	v=0, J=12	v=0, J=13	v=0, J=14	v=0, J=15	v=0, J=16	v=0, J=17
4100	1.3404 -14	3.3391 -14	8.6651 -14	2.3433 -13	6.5182 -13	1.8704 -12
4200	1.5720 -14	3.8755 -14	9.9491 -14	2.6607 -13	7.3174 -13	2.0752 -12
4300	1.8286 -14	4.4640 -14	1.1343 -13	3.0013 -13	8.1651 -13	2.2898 -12
4400	2.1113 -14	5.1057 -14	1.2846 -13	3.3648 -13	9.0598 -13	2.5137 -12
4500	2.4207 -14	5.8013 -14	1.4461 -13	3.7510 -13	1.0000 -12	2.7463 -12
4600	2.7574 -14	6.5514 -14	1.6184 -13	4.1593 -13	1.0984 -12	2.9873 -12
4700	3.1218 -14	7.3562 -14	1.8017 -13	4.5892 -13	1.2010 -12	3.2359 -12
4800	3.5143 -14	8.2156 -14	1.9957 -13	5.0401 -13	1.3076 -12	3.4916 -12
4900	3.9349 -14	9.1293 -14	2.2002 -13	5.5112 -13	1.4180 -12	3.7538 -12
5000	4.3839 -14	1.0097 -13	2.4149 -13	6.0019 -13	1.5319 -12	4.0221 -12
5500	7.0470 -14	1.5711 -13	3.6326 -13	8.7174 -13	2.1471 -12	5.4332 -12
6000	1.0367 -13	2.2493 -13	5.0560 -13	1.1784 -12	2.8172 -12	6.9133 -12
6500	1.4254 -13	3.0224 -13	6.6331 -13	1.5081 -12	3.5159 -12	8.4061 -12
7000	1.8594 -13	3.8655 -13	8.3112 -13	1.8499 -12	4.2204 -12	9.8680 -12
7500	2.3265 -13	4.7543 -13	1.0042 -12	2.1943 -12	4.9131 -12	1.1267 -11
8000	2.8149 -13	5.6666 -13	1.1783 -12	2.5336 -12	5.5804 -12	1.2583 -11
8500	3.3139 -13	6.5832 -13	1.3502 -12	2.8621 -12	6.2131 -12	1.3801 -11
9000	3.8143 -13	7.4884 -13	1.5171 -12	3.1754 -12	6.8049 -12	1.4916 -11
9500	4.3086 -13	8.3698 -13	1.6772 -12	3.4708 -12	7.3524 -12	1.5925 -11
10000	4.7906 -13	9.2180 -13	1.8290 -12	3.7464 -12	7.8540 -12	1.6830 -11
11000	5.7004 -13	1.0789 -12	2.1045 -12	4.2351 -12	8.7203 -12	1.8343 -11
12000	6.5199 -13	1.2172 -12	2.3405 -12	4.6411 -12	9.4137 -12	1.9497 -11
13000	7.2389 -13	1.3358 -12	2.5377 -12	4.9695 -12	9.9525 -12	2.0345 -11
14000	7.8566 -13	1.4354 -12	2.6987 -12	5.2283 -12	1.0357 -11	2.0935 -11
15000	8.3773 -13	1.5173 -12	2.8271 -12	5.4263 -12	1.0648 -11	2.1315 -11
16000	8.8083 -13	1.5832 -12	2.9268 -12	5.5722 -12	1.0844 -11	2.1522 -11
17000	9.1583 -13	1.6351 -12	3.0018 -12	5.6739 -12	1.0961 -11	2.1592 -11
18000	9.4365 -13	1.6748 -12	3.0556 -12	5.7386 -12	1.1014 -11	2.1551 -11
19000	9.6515 -13	1.7038 -12	3.0913 -12	5.7725 -12	1.1015 -11	2.1423 -11
20000	9.8116 -13	1.7237 -12	3.1119 -12	5.7810 -12	1.0973 -11	2.1227 -11
21000	9.9242 -13	1.7359 -12	3.1197 -12	5.7685 -12	1.0898 -11	2.0978 -11
22000	9.9960 -13	1.7416 -12	3.1170 -12	5.7390 -12	1.0795 -11	2.0688 -11
23000	1.0033 -12	1.7417 -12	3.1055 -12	5.6956 -12	1.0671 -11	2.0368 -11
24000	1.0040 -12	1.7371 -12	3.0867 -12	5.6411 -12	1.0531 -11	2.0025 -11
25000	1.0022 -12	1.7288 -12	3.0621 -12	5.5777 -12	1.0378 -11	1.9666 -11
26000	9.9834 -13	1.7172 -12	3.0326 -12	5.5074 -12	1.0216 -11	1.9297 -11
27000	9.9265 -13	1.7029 -12	2.9993 -12	5.4316 -12	1.0046 -11	1.8922 -11
28000	9.8548 -13	1.6865 -12	2.9629 -12	5.3516 -12	9.8722 -12	1.8543 -11
29000	9.7707 -13	1.6683 -12	2.9241 -12	5.2687 -12	9.6952 -12	1.8165 -11
30000	9.6764 -13	1.6487 -12	2.8834 -12	5.1836 -12	9.5167 -12	1.7788 -11

Table 4. Rate constant for hydrogen molecule in  $v=0$  and  $J=18-23$  states.

T(K)	$v=0, J=18$	$v=0, J=19$	$v=0, J=20$	$v=0, J=21$	$v=0, J=22$	$v=0, J=23$
100	---	---	---	---	---	---
200	---	---	---	---	---	7.7476 -29
300	---	---	---	4.4611 -28	7.5254 -25	4.3952 -22
400	---	3.6313 -28	1.0001 -25	3.1484 -23	9.2404 -21	1.0738 -18
500	2.1016 -26	2.2410 -24	2.2454 -22	2.4802 -20	2.5596 -18	1.1647 -16
600	1.3742 -23	7.3813 -22	3.7690 -20	2.0731 -18	1.0682 -16	2.6442 -15
700	1.3870 -21	4.5669 -20	1.4407 -18	4.8198 -17	1.5142 -15	2.4490 -14
800	4.3609 -20	9.9512 -19	2.1877 -17	5.0436 -16	1.0943 -14	1.2934 -13
900	6.3077 -19	1.0825 -17	1.7969 -16	3.1027 -15	5.0512 -14	4.6944 -13
1000	5.3019 -18	7.2452 -17	9.6072 -16	1.3168 -14	1.7045 -13	1.3101 -12
1100	3.0047 -17	3.4083 -16	3.7607 -15	4.2684 -14	4.5819 -13	3.0198 -12
1200	1.2675 -16	1.2312 -15	1.1656 -14	1.1308 -13	1.0389 -12	6.0308 -12
1300	4.2621 -16	3.6312 -15	3.0201 -14	2.5659 -13	2.0669 -12	1.0786 -11
1400	1.1996 -15	9.1340 -15	6.7986 -14	5.1561 -13	3.7116 -12	1.7690 -11
1500	2.9288 -15	2.0234 -14	1.3679 -13	9.4033 -13	6.1414 -12	2.7073 -11
1600	6.3723 -15	4.0431 -14	2.5129 -13	1.5852 -12	9.5096 -12	3.9169 -11
1700	1.2610 -14	7.4226 -14	4.2833 -13	2.5050 -12	1.3944 -11	5.4111 -11
1800	2.3063 -14	1.2699 -13	6.8604 -13	3.7514 -12	1.9539 -11	7.1931 -11
1900	3.9472 -14	2.0476 -13	1.0428 -12	5.3697 -12	2.6357 -11	9.2578 -11
2000	6.3860 -14	3.1396 -13	1.5163 -12	7.3973 -12	3.4425 -11	1.1593 -10
2100	9.8459 -14	4.6113 -13	2.1227 -12	9.8621 -12	4.3736 -11	1.4180 -10
2200	1.4563 -13	6.5263 -13	2.8760 -12	1.2782 -11	5.4259 -11	1.6997 -10
2300	2.0778 -13	8.9441 -13	3.7876 -12	1.6166 -11	6.5940 -11	2.0020 -10
2400	2.8727 -13	1.1918 -12	4.8659 -12	2.0013 -11	7.8706 -11	2.3221 -10
2500	3.8634 -13	1.5493 -12	6.1168 -12	2.4314 -11	9.2469 -11	2.6576 -10
2600	5.0705 -13	1.9706 -12	7.5430 -12	2.9056 -11	1.0714 -10	3.0056 -10
2700	6.5122 -13	2.4586 -12	9.1447 -12	3.4216 -11	1.2260 -10	3.3636 -10
2800	8.2039 -13	3.0150 -12	1.0920 -11	3.9769 -11	1.3877 -10	3.7292 -10
2900	1.0158 -12	3.6409 -12	1.2863 -11	4.5686 -11	1.5553 -10	4.1001 -10
3000	1.2385 -12	4.3362 -12	1.4970 -11	5.1937 -11	1.7279 -10	4.4742 -10
3100	1.4889 -12	5.1004 -12	1.7231 -11	5.8487 -11	1.9044 -10	4.8496 -10
3200	1.7676 -12	5.9320 -12	1.9638 -11	6.5303 -11	2.0840 -10	5.2245 -10
3300	2.0745 -12	6.8290 -12	2.2181 -11	7.2353 -11	2.2657 -10	5.5973 -10
3400	2.4093 -12	7.7890 -12	2.4850 -11	7.9601 -11	2.4488 -10	5.9667 -10
3500	2.7718 -12	8.8088 -12	2.7633 -11	8.7016 -11	2.6324 -10	6.3315 -10
3600	3.1611 -12	9.8853 -12	3.0519 -11	9.4566 -11	2.8160 -10	6.6906 -10
3700	3.5765 -12	1.1015 -11	3.3496 -11	1.0222 -10	2.9988 -10	7.0431 -10
3800	4.0169 -12	1.2193 -11	3.6554 -11	1.0996 -10	3.1804 -10	7.3882 -10
3900	4.4812 -12	1.3417 -11	3.9682 -11	1.1774 -10	3.3602 -10	7.7254 -10
4000	4.9681 -12	1.4683 -11	4.2867 -11	1.2555 -10	3.5377 -10	8.0539 -10

Table 4. (continued)

T(K)	v=0, J=18	v=0, J=19	v=0, J=20	v=0, J=21	v=0, J=22	v=0, J=23
4100	5.4762 -12	1.5985 -11	4.6101 -11	1.3336 -10	3.7127 -10	8.3735 -10
4200	6.0042 -12	1.7320 -11	4.9373 -11	1.4115 -10	3.8846 -10	8.6838 -10
4300	6.5506 -12	1.8685 -11	5.2674 -11	1.4891 -10	4.0533 -10	8.9844 -10
4400	7.1139 -12	2.0075 -11	5.5994 -11	1.5661 -10	4.2185 -10	9.2753 -10
4500	7.6926 -12	2.1486 -11	5.9325 -11	1.6424 -10	4.3800 -10	9.5564 -10
4600	8.2852 -12	2.2915 -11	6.2660 -11	1.7178 -10	4.5376 -10	9.8274 -10
4700	8.8903 -12	2.4358 -11	6.5990 -11	1.7922 -10	4.6911 -10	1.0089 -09
4800	9.5063 -12	2.5813 -11	6.9309 -11	1.8656 -10	4.8405 -10	1.0340 -09
4900	1.0132 -11	2.7274 -11	7.2612 -11	1.9377 -10	4.9856 -10	1.0581 -09
5000	1.0766 -11	2.8741 -11	7.5891 -11	2.0086 -10	5.1264 -10	1.0812 -09
5500	1.4012 -11	3.6050 -11	9.1775 -11	2.3413 -10	5.7652 -10	1.1828 -09
6000	1.7285 -11	4.3120 -11	1.0648 -10	2.6346 -10	6.2968 -10	1.2626 -09
6500	2.0473 -11	4.9757 -11	1.1975 -10	2.8872 -10	6.7287 -10	1.3233 -09
7000	2.3498 -11	5.5846 -11	1.3147 -10	3.1002 -10	7.0711 -10	1.3678 -09
7500	2.6311 -11	6.1331 -11	1.4164 -10	3.2767 -10	7.3353 -10	1.3987 -09
8000	2.8884 -11	6.6197 -11	1.5034 -10	3.4199 -10	7.5321 -10	1.4183 -09
8500	3.1207 -11	7.0456 -11	1.5767 -10	3.5338 -10	7.6717 -10	1.4287 -09
9000	3.3278 -11	7.4137 -11	1.6374 -10	3.6219 -10	7.7631 -10	1.4316 -09
9500	3.5105 -11	7.7280 -11	1.6869 -10	3.6876 -10	7.8142 -10	1.4284 -09
10000	3.6700 -11	7.9930 -11	1.7263 -10	3.7341 -10	7.8318 -10	1.4204 -09
11000	3.9258 -11	8.3929 -11	1.7798 -10	3.7800 -10	7.7887 -10	1.3935 -09
12000	4.1083 -11	8.6482 -11	1.8062 -10	3.7780 -10	7.6704 -10	1.3568 -09
13000	4.2306 -11	8.7898 -11	1.8122 -10	3.7420 -10	7.5030 -10	1.3146 -09
14000	4.3043 -11	8.8430 -11	1.8031 -10	3.6823 -10	7.3047 -10	1.2693 -09
15000	4.3394 -11	8.8287 -11	1.7830 -10	3.6065 -10	7.0883 -10	1.2230 -09
16000	4.3441 -11	8.7633 -11	1.7550 -10	3.5201 -10	6.8628 -10	1.1767 -09
17000	4.3251 -11	8.6596 -11	1.7214 -10	3.4273 -10	6.6342 -10	1.1313 -09
18000	4.2879 -11	8.5278 -11	1.6841 -10	3.3310 -10	6.4069 -10	1.0872 -09
19000	4.2368 -11	8.3757 -11	1.6443 -10	3.2332 -10	6.1837 -10	1.0448 -09
20000	4.1752 -11	8.2095 -11	1.6032 -10	3.1356 -10	5.9664 -10	1.0041 -09
21000	4.1059 -11	8.0339 -11	1.5613 -10	3.0392 -10	5.7563 -10	9.6530 -10
22000	4.0310 -11	7.8525 -11	1.5194 -10	2.9448 -10	5.5540 -10	9.2837 -10
23000	3.9524 -11	7.6682 -11	1.4778 -10	2.8528 -10	5.3599 -10	8.9328 -10
24000	3.8713 -11	7.4830 -11	1.4369 -10	2.7636 -10	5.1741 -10	8.5999 -10
25000	3.7888 -11	7.2986 -11	1.3968 -10	2.6775 -10	4.9966 -10	8.2842 -10
26000	3.7059 -11	7.1162 -11	1.3576 -10	2.5944 -10	4.8271 -10	7.9849 -10
27000	3.6230 -11	6.9368 -11	1.3196 -10	2.5145 -10	4.6655 -10	7.7011 -10
28000	3.5408 -11	6.7610 -11	1.2827 -10	2.4377 -10	4.5115 -10	7.4321 -10
29000	3.4597 -11	6.5893 -11	1.2470 -10	2.3640 -10	4.3647 -10	7.1770 -10
30000	3.3798 -11	6.4221 -11	1.2126 -10	2.2934 -10	4.2247 -10	6.9350 -10

Table 5. Rate constant for hydrogen molecule in  $v=0$  and  $J=24-29$  states.

T(K)	$v=0, J=24$	$v=0, J=25$	$v=0, J=26$	$v=0, J=27$	$v=0, J=28$	$v=0, J=29$
100	---	---	2.9130 -25	4.7735 -18	7.9875 -14	3.3792 -12
200	2.8782 -25	8.7559 -22	2.0666 -18	2.6238 -15	5.3444 -13	1.4698 -11
300	7.9176 -20	9.8931 -18	9.9765 -16	7.2984 -14	2.9046 -12	4.7337 -11
400	4.8973 -17	1.5702 -15	4.1664 -14	8.8158 -13	1.3747 -11	1.3505 -10
500	2.4638 -15	3.8525 -14	5.1007 -13	5.6178 -12	4.9777 -11	3.2812 -10
600	3.4321 -14	3.4457 -13	2.9816 -12	2.2002 -11	1.3583 -10	6.7092 -10
700	2.2680 -13	1.6831 -12	1.0914 -11	6.1374 -11	2.9563 -10	1.1843 -09
800	9.3548 -13	5.5707 -12	2.9302 -11	1.3532 -10	5.4413 -10	1.8643 -09
900	2.8112 -12	1.4154 -11	6.3504 -11	2.5258 -10	8.8536 -10	2.6891 -09
1000	6.7602 -12	2.9817 -11	1.1805 -10	4.1757 -10	1.3141 -09	3.6285 -09
1100	1.3815 -11	5.4744 -11	1.9593 -10	6.3053 -10	1.8192 -09	4.6500 -09
1200	2.4980 -11	9.0603 -11	2.9837 -10	8.8833 -10	2.3862 -09	5.7228 -09
1300	4.1102 -11	1.3840 -10	4.2502 -10	1.1856 -09	2.9998 -09	6.8202 -09
1400	6.2794 -11	1.9846 -10	5.7431 -10	1.5159 -09	3.6453 -09	7.9199 -09
1500	9.0402 -11	2.7053 -10	7.4382 -10	1.8721 -09	4.3095 -09	9.0041 -09
1600	1.2402 -10	3.5387 -10	9.3062 -10	2.2473 -09	4.9808 -09	1.0059 -08
1700	1.6351 -10	4.4744 -10	1.1316 -09	2.6353 -09	5.6497 -09	1.1075 -08
1800	2.0855 -10	5.4995 -10	1.3435 -09	3.0302 -09	6.3082 -09	1.2045 -08
1900	2.5871 -10	6.6003 -10	1.5635 -09	3.4271 -09	6.9502 -09	1.2963 -08
2000	3.1343 -10	7.7628 -10	1.7887 -09	3.8217 -09	7.5710 -09	1.3827 -08
2100	3.7213 -10	8.9730 -10	2.0166 -09	4.2106 -09	8.1671 -09	1.4636 -08
2200	4.3418 -10	1.0218 -09	2.2450 -09	4.5908 -09	8.7360 -09	1.5390 -08
2300	4.9897 -10	1.1486 -09	2.4721 -09	4.9601 -09	9.2761 -09	1.6088 -08
2400	5.6590 -10	1.2766 -09	2.6963 -09	5.3167 -09	9.7865 -09	1.6733 -08
2500	6.3441 -10	1.4048 -09	2.9162 -09	5.6595 -09	1.0267 -08	1.7326 -08
2600	7.0397 -10	1.5323 -09	3.1307 -09	5.9874 -09	1.0717 -08	1.7870 -08
2700	7.7411 -10	1.6585 -09	3.3390 -09	6.2998 -09	1.1137 -08	1.8365 -08
2800	8.4439 -10	1.7827 -09	3.5404 -09	6.5965 -09	1.1529 -08	1.8816 -08
2900	9.1443 -10	1.9044 -09	3.7344 -09	6.8772 -09	1.1892 -08	1.9224 -08
3000	9.8389 -10	2.0232 -09	3.9206 -09	7.1421 -09	1.2228 -08	1.9592 -08
3100	1.0525 -09	2.1386 -09	4.0987 -09	7.3912 -09	1.2538 -08	1.9921 -08
3200	1.1199 -09	2.2505 -09	4.2687 -09	7.6250 -09	1.2823 -08	2.0216 -08
3300	1.1860 -09	2.3585 -09	4.4305 -09	7.8438 -09	1.3084 -08	2.0477 -08
3400	1.2506 -09	2.4627 -09	4.5841 -09	8.0480 -09	1.3322 -08	2.0707 -08
3500	1.3136 -09	2.5627 -09	4.7295 -09	8.2381 -09	1.3539 -08	2.0909 -08
3600	1.3747 -09	2.6587 -09	4.8669 -09	8.4146 -09	1.3735 -08	2.1083 -08
3700	1.4340 -09	2.7505 -09	4.9965 -09	8.5781 -09	1.3913 -08	2.1233 -08
3800	1.4913 -09	2.8381 -09	5.1184 -09	8.7292 -09	1.4072 -08	2.1359 -08
3900	1.5466 -09	2.9217 -09	5.2329 -09	8.8683 -09	1.4214 -08	2.1463 -08
4000	1.5999 -09	3.0011 -09	5.3402 -09	8.9961 -09	1.4341 -08	2.1548 -08

Table 5. (continued)

T(K)	v=0, J=24	v=0, J=25	v=0, J=26	v=0, J=27	v=0, J=28	v=0, J=29
4100	1.6511 -09	3.0765 -09	5.4405 -09	9.1131 -09	1.4452 -08	2.1614 -08
4200	1.7003 -09	3.1480 -09	5.5341 -09	9.2198 -09	1.4549 -08	2.1663 -08
4300	1.7474 -09	3.2156 -09	5.6212 -09	9.3168 -09	1.4633 -08	2.1696 -08
4400	1.7925 -09	3.2795 -09	5.7021 -09	9.4045 -09	1.4705 -08	2.1714 -08
4500	1.8355 -09	3.3397 -09	5.7771 -09	9.4836 -09	1.4765 -08	2.1719 -08
4600	1.8766 -09	3.3964 -09	5.8464 -09	9.5543 -09	1.4814 -08	2.1711 -08
4700	1.9157 -09	3.4497 -09	5.9103 -09	9.6173 -09	1.4853 -08	2.1692 -08
4800	1.9529 -09	3.4997 -09	5.9690 -09	9.6728 -09	1.4883 -08	2.1662 -08
4900	1.9882 -09	3.5465 -09	6.0227 -09	9.7215 -09	1.4904 -08	2.1623 -08
5000	2.0218 -09	3.5902 -09	6.0717 -09	9.7635 -09	1.4917 -08	2.1574 -08
5500	2.1638 -09	3.7667 -09	6.2539 -09	9.8884 -09	1.4877 -08	2.1221 -08
6000	2.2679 -09	3.8832 -09	6.3491 -09	9.8991 -09	1.4704 -08	2.0734 -08
6500	2.3406 -09	3.9519 -09	6.3781 -09	9.8270 -09	1.4440 -08	2.0164 -08
7000	2.3875 -09	3.9830 -09	6.3573 -09	9.6960 -09	1.4116 -08	1.9547 -08
7500	2.4136 -09	3.9850 -09	6.2994 -09	9.5235 -09	1.3754 -08	1.8909 -08
8000	2.4231 -09	3.9645 -09	6.2143 -09	9.3228 -09	1.3370 -08	1.8265 -08
8500	2.4195 -09	3.9268 -09	6.1097 -09	9.1038 -09	1.2975 -08	1.7627 -08
9000	2.4054 -09	3.8763 -09	5.9913 -09	8.8736 -09	1.2578 -08	1.7002 -08
9500	2.3833 -09	3.8162 -09	5.8636 -09	8.6377 -09	1.2183 -08	1.6396 -08
10000	2.3549 -09	3.7492 -09	5.7300 -09	8.4000 -09	1.1796 -08	1.5810 -08
11000	2.2852 -09	3.6022 -09	5.4550 -09	7.9299 -09	1.1050 -08	1.4709 -08
12000	2.2050 -09	3.4471 -09	5.1802 -09	7.4778 -09	1.0354 -08	1.3703 -08
13000	2.1199 -09	3.2909 -09	4.9134 -09	7.0507 -09	9.7099 -09	1.2788 -08
14000	2.0335 -09	3.1378 -09	4.6588 -09	6.6515 -09	9.1178 -09	1.1958 -08
15000	1.9481 -09	2.9904 -09	4.4185 -09	6.2806 -09	8.5747 -09	1.1205 -08
16000	1.8650 -09	2.8498 -09	4.1931 -09	5.9372 -09	8.0773 -09	1.0521 -08
17000	1.7851 -09	2.7168 -09	3.9824 -09	5.6196 -09	7.6215 -09	9.8994 -09
18000	1.7088 -09	2.5914 -09	3.7859 -09	5.3262 -09	7.2036 -09	9.3332 -09
19000	1.6363 -09	2.4735 -09	3.6029 -09	5.0551 -09	6.8200 -09	8.8162 -09
20000	1.5676 -09	2.3628 -09	3.4326 -09	4.8043 -09	6.4672 -09	8.3433 -09
21000	1.5028 -09	2.2591 -09	3.2739 -09	4.5721 -09	6.1422 -09	7.9096 -09
22000	1.4415 -09	2.1619 -09	3.1261 -09	4.3569 -09	5.8423 -09	7.5109 -09
23000	1.3837 -09	2.0707 -09	2.9883 -09	4.1571 -09	5.5651 -09	7.1436 -09
24000	1.3292 -09	1.9852 -09	2.8596 -09	3.9714 -09	5.3083 -09	6.8045 -09
25000	1.2779 -09	1.9050 -09	2.7394 -09	3.7986 -09	5.0701 -09	6.4908 -09
26000	1.2294 -09	1.8297 -09	2.6269 -09	3.6374 -09	4.8486 -09	6.1999 -09
27000	1.1837 -09	1.7589 -09	2.5216 -09	3.4869 -09	4.6424 -09	5.9297 -09
28000	1.1405 -09	1.6923 -09	2.4228 -09	3.3462 -09	4.4501 -09	5.6782 -09
29000	1.0997 -09	1.6295 -09	2.3301 -09	3.2144 -09	4.2703 -09	5.4437 -09
30000	1.0612 -09	1.5704 -09	2.2429 -09	3.0909 -09	4.1021 -09	5.2246 -09

Table 6. Rate constant for hydrogen molecule in  $v=0$  and  $J=30-31$  states and  $v=1$  and  $J=0-3$  states.

T(K)	$v=0, J=30$	$v=0, J=31$	$v=1, J=0$	$v=1, J=1$	$v=1, J=2$	$v=1, J=3$
100	4.2546 -11	2.6613 -10	---	---	---	---
200	1.4600 -10	7.8945 -10	---	---	---	---
300	3.6401 -10	1.6652 -09	---	---	---	---
400	7.8472 -10	2.9946 -09	---	---	---	---
500	1.4808 -09	4.7795 -09	---	---	---	---
600	2.4727 -09	6.9364 -09	---	---	---	---
700	3.7314 -09	9.3460 -09	---	---	---	---
800	5.1997 -09	1.1891 -08	---	---	---	---
900	6.8124 -09	1.4473 -08	6.6218 -29	8.1565 -29	1.2690 -28	2.4627 -28
1000	8.5079 -09	1.7018 -08	3.8761 -27	4.6948 -27	7.0445 -27	1.2948 -26
1100	1.0234 -08	1.9471 -08	1.0751 -25	1.2844 -25	1.8709 -25	3.2891 -25
1200	1.1950 -08	2.1798 -08	1.7037 -24	2.0121 -24	2.8594 -24	4.8440 -24
1300	1.3623 -08	2.3977 -08	1.7559 -23	2.0537 -23	2.8581 -23	4.6920 -23
1400	1.5231 -08	2.5995 -08	1.2909 -22	1.4973 -22	2.0467 -22	3.2709 -22
1500	1.6759 -08	2.7849 -08	7.2447 -22	8.3428 -22	1.1228 -21	1.7529 -21
1600	1.8196 -08	2.9538 -08	3.2655 -21	3.7368 -21	4.9611 -21	7.5888 -21
1700	1.9538 -08	3.1068 -08	1.2290 -20	1.3985 -20	1.8346 -20	2.7561 -20
1800	2.0783 -08	3.2446 -08	3.9804 -20	4.5070 -20	5.8494 -20	8.6478 -20
1900	2.1929 -08	3.3678 -08	1.1361 -19	1.2807 -19	1.6463 -19	2.3993 -19
2000	2.2980 -08	3.4774 -08	2.9128 -19	3.2704 -19	4.1680 -19	5.9961 -19
2100	2.3938 -08	3.5743 -08	6.8120 -19	7.6208 -19	9.6370 -19	1.3703 -18
2200	2.4807 -08	3.6594 -08	1.4717 -18	1.6410 -18	2.0605 -18	2.8987 -18
2300	2.5593 -08	3.7337 -08	2.9677 -18	3.2992 -18	4.1159 -18	5.7343 -18
2400	2.6299 -08	3.7979 -08	5.6348 -18	6.2470 -18	7.7471 -18	1.0698 -17
2500	2.6931 -08	3.8530 -08	1.0147 -17	1.1221 -17	1.3840 -17	1.8954 -17
2600	2.7492 -08	3.8996 -08	1.7438 -17	1.9238 -17	2.3608 -17	3.2088 -17
2700	2.7989 -08	3.9385 -08	2.8746 -17	3.1645 -17	3.8652 -17	5.2169 -17
2800	2.8426 -08	3.9704 -08	4.5664 -17	5.0167 -17	6.1011 -17	8.1811 -17
2900	2.8806 -08	3.9959 -08	7.0170 -17	7.6946 -17	9.3199 -17	1.2422 -16
3000	2.9135 -08	4.0155 -08	1.0466 -16	1.1456 -16	1.3824 -16	1.8320 -16
3100	2.9416 -08	4.0299 -08	1.5195 -16	1.6605 -16	1.9966 -16	2.6321 -16
3200	2.9653 -08	4.0395 -08	2.1529 -16	2.3491 -16	2.8153 -16	3.6928 -16
3300	2.9850 -08	4.0447 -08	2.9836 -16	3.2508 -16	3.8838 -16	5.0706 -16
3400	3.0009 -08	4.0460 -08	4.0523 -16	4.4092 -16	5.2522 -16	6.8271 -16
3500	3.0134 -08	4.0437 -08	5.4034 -16	5.8718 -16	6.9750 -16	9.0288 -16
3600	3.0227 -08	4.0382 -08	7.0844 -16	7.6892 -16	9.1100 -16	1.1746 -15
3700	3.0292 -08	4.0298 -08	9.1458 -16	9.9151 -16	1.1718 -15	1.5053 -15
3800	3.0330 -08	4.0188 -08	1.1640 -15	1.2605 -15	1.4863 -15	1.9026 -15
3900	3.0344 -08	4.0054 -08	1.4621 -15	1.5817 -15	1.8609 -15	2.3741 -15
4000	3.0336 -08	3.9900 -08	1.8145 -15	1.9610 -15	2.3021 -15	2.9278 -15

Table 6. (continued)

T(K)	v=0, J=30	v=0, J=31	v=1, J=0	v=1, J=1	v=1, J=2	v=1, J=3
4100	3.0307 -08	3.9726 -08	2.2266 -15	2.4041 -15	2.8167 -15	3.5713 -15
4200	3.0260 -08	3.9535 -08	2.7039 -15	2.9169 -15	3.4110 -15	4.3124 -15
4300	3.0197 -08	3.9329 -08	3.2520 -15	3.5052 -15	4.0914 -15	5.1584 -15
4400	3.0118 -08	3.9110 -08	3.8762 -15	4.1746 -15	4.8642 -15	6.1167 -15
4500	3.0025 -08	3.8879 -08	4.5815 -15	4.9304 -15	5.7352 -15	7.1939 -15
4600	2.9920 -08	3.8637 -08	5.3729 -15	5.7777 -15	6.7101 -15	8.3966 -15
4700	2.9803 -08	3.8386 -08	6.2550 -15	6.7214 -15	7.7942 -15	9.7308 -15
4800	2.9676 -08	3.8127 -08	7.2320 -15	7.7661 -15	8.9924 -15	1.1202 -14
4900	2.9539 -08	3.7860 -08	8.3081 -15	8.9158 -15	1.0309 -14	1.2815 -14
5000	2.9394 -08	3.7588 -08	9.4869 -15	1.0174 -14	1.1748 -14	1.4575 -14
5500	2.8571 -08	3.6161 -08	1.7021 -14	1.8204 -14	2.0893 -14	2.5686 -14
6000	2.7639 -08	3.4682 -08	2.7447 -14	2.9284 -14	3.3443 -14	4.0803 -14
6500	2.6655 -08	3.3204 -08	4.0791 -14	4.3436 -14	4.9392 -14	5.9879 -14
7000	2.5655 -08	3.1759 -08	5.6887 -14	6.0473 -14	6.8514 -14	8.2604 -14
7500	2.4662 -08	3.0364 -08	7.5428 -14	8.0063 -14	9.0421 -14	1.0850 -13
8000	2.3692 -08	2.9031 -08	9.6021 -14	1.0179 -13	1.1464 -13	1.3698 -13
8500	2.2754 -08	2.7764 -08	1.1824 -13	1.2520 -13	1.4065 -13	1.6745 -13
9000	2.1853 -08	2.6565 -08	1.4165 -13	1.4983 -13	1.6796 -13	1.9930 -13
9500	2.0993 -08	2.5433 -08	1.6584 -13	1.7527 -13	1.9609 -13	2.3199 -13
10000	2.0173 -08	2.4366 -08	1.9045 -13	2.0111 -13	2.2460 -13	2.6502 -13
11000	1.8656 -08	2.2415 -08	2.3966 -13	2.5271 -13	2.8137 -13	3.3047 -13
12000	1.7292 -08	2.0685 -08	2.8722 -13	3.0250 -13	3.3595 -13	3.9308 -13
13000	1.6069 -08	1.9150 -08	3.3180 -13	3.4909 -13	3.8686 -13	4.5117 -13
14000	1.4971 -08	1.7784 -08	3.7258 -13	3.9166 -13	4.3323 -13	5.0384 -13
15000	1.3984 -08	1.6565 -08	4.0919 -13	4.2983 -13	4.7468 -13	5.5071 -13
16000	1.3094 -08	1.5474 -08	4.4155 -13	4.6351 -13	5.1115 -13	5.9177 -13
17000	1.2291 -08	1.4492 -08	4.6974 -13	4.9282 -13	5.4280 -13	6.2723 -13
18000	1.1562 -08	1.3607 -08	4.9398 -13	5.1799 -13	5.6988 -13	6.5743 -13
19000	1.0901 -08	1.2806 -08	5.1456 -13	5.3932 -13	5.9276 -13	6.8280 -13
20000	1.0298 -08	1.2079 -08	5.3179 -13	5.5714 -13	6.1180 -13	7.0379 -13
21000	9.7467 -09	1.1417 -08	5.4599 -13	5.7180 -13	6.2739 -13	7.2084 -13
22000	9.2420 -09	1.0812 -08	5.5747 -13	5.8362 -13	6.3989 -13	7.3439 -13
23000	8.7784 -09	1.0257 -08	5.6653 -13	5.9292 -13	6.4964 -13	7.4483 -13
24000	8.3516 -09	9.7480 -09	5.7344 -13	5.9998 -13	6.5698 -13	7.5254 -13
25000	7.9576 -09	9.2789 -09	5.7847 -13	6.0508 -13	6.6218 -13	7.5785 -13
26000	7.5931 -09	8.8458 -09	5.8184 -13	6.0846 -13	6.6553 -13	7.6107 -13
27000	7.2552 -09	8.4450 -09	5.8375 -13	6.1032 -13	6.6724 -13	7.6248 -13
28000	6.9413 -09	8.0732 -09	5.8440 -13	6.1087 -13	6.6754 -13	7.6230 -13
29000	6.6491 -09	7.7276 -09	5.8394 -13	6.1027 -13	6.6660 -13	7.6075 -13
30000	6.3766 -09	7.4058 -09	5.8253 -13	6.0869 -13	6.6461 -13	7.5803 -13

Table 7. Rate constant for hydrogen molecule in  $v=1$  and  $J=4-9$  states.

T(K)	$v=1, J=4$	$v=1, J=5$	$v=1, J=6$	$v=1, J=7$	$v=1, J=8$	$v=1, J=9$
100	---	---	---	---	---	---
200	---	---	---	---	---	---
300	---	---	---	---	---	---
400	---	---	---	---	---	---
500	---	---	---	---	---	---
600	---	---	---	---	---	---
700	---	---	---	---	---	5.6587 -29
800	---	1.4313 -29	5.7710 -29	2.8276 -28	1.6623 -27	1.1877 -26
900	5.8094 -28	1.6839 -27	5.9689 -27	2.5256 -26	1.2613 -25	7.5199 -25
1000	2.8482 -26	7.5711 -26	2.4208 -25	9.1086 -25	3.9923 -24	2.0593 -23
1100	6.8330 -25	1.6921 -24	4.9723 -24	1.6996 -23	6.6949 -23	3.0673 -22
1200	9.5948 -24	2.2396 -23	6.1343 -23	1.9355 -22	6.9748 -22	2.8948 -21
1300	8.9261 -23	1.9819 -22	5.1145 -22	1.5080 -21	5.0401 -21	1.9240 -20
1400	6.0108 -22	1.2785 -21	3.1352 -21	8.7227 -21	2.7329 -20	9.7102 -20
1500	3.1261 -21	6.4066 -21	1.5030 -20	3.9763 -20	1.1779 -19	3.9331 -19
1600	1.3182 -20	2.6150 -20	5.9016 -20	1.4940 -19	4.2143 -19	1.3326 -18
1700	4.6778 -20	9.0165 -20	1.9664 -19	4.7881 -19	1.2934 -18	3.8981 -18
1800	1.4378 -19	2.7014 -19	5.7150 -19	1.3443 -18	3.4943 -18	1.0090 -17
1900	3.9161 -19	7.1912 -19	1.4805 -18	3.3762 -18	8.4792 -18	2.3567 -17
2000	9.6255 -19	1.7315 -18	3.4784 -18	7.7142 -18	1.8783 -17	5.0438 -17
2100	2.1668 -18	3.8257 -18	7.5168 -18	1.6255 -17	3.8484 -17	1.0017 -16
2200	4.5214 -18	7.8488 -18	1.5113 -17	3.1941 -17	7.3717 -17	1.8652 -16
2300	8.8331 -18	1.5098 -17	2.8540 -17	5.9068 -17	1.3318 -16	3.2837 -16
2400	1.6291 -17	2.7451 -17	5.1023 -17	1.0359 -16	2.2863 -16	5.5048 -16
2500	2.8561 -17	4.7503 -17	8.6927 -17	1.7339 -16	3.7524 -16	8.8395 -16
2600	4.7883 -17	7.8681 -17	1.4193 -16	2.7851 -16	5.9189 -16	1.3665 -15
2700	7.7148 -17	1.2536 -16	2.2314 -16	4.3130 -16	9.0130 -16	2.0423 -15
2800	1.1997 -16	1.9293 -16	3.3919 -16	6.4646 -16	1.3300 -15	2.9618 -15
2900	1.8074 -16	2.8785 -16	5.0026 -16	9.4105 -16	1.9081 -15	4.1812 -15
3000	2.6463 -16	4.1765 -16	7.1809 -16	1.3344 -15	2.6692 -15	5.7612 -15
3100	3.7760 -16	5.9092 -16	1.0058 -15	1.8478 -15	3.6495 -15	7.7667 -15
3200	5.2639 -16	8.1726 -16	1.3780 -15	2.5046 -15	4.8879 -15	1.0265 -14
3300	7.1845 -16	1.1071 -15	1.8503 -15	3.3292 -15	6.4249 -15	1.3326 -14
3400	9.6186 -16	1.4719 -15	2.4394 -15	4.3476 -15	8.3023 -15	1.7020 -14
3500	1.2653 -15	1.9234 -15	3.1626 -15	5.5864 -15	1.0562 -14	2.1415 -14
3600	1.6378 -15	2.4741 -15	4.0380 -15	7.0726 -15	1.3247 -14	2.6579 -14
3700	2.0889 -15	3.1368 -15	5.0837 -15	8.8331 -15	1.6398 -14	3.2578 -14
3800	2.6282 -15	3.9246 -15	6.3179 -15	1.0895 -14	2.0056 -14	3.9473 -14
3900	3.2655 -15	4.8503 -15	7.7589 -15	1.3284 -14	2.4258 -14	4.7321 -14
4000	4.0106 -15	5.9269 -15	9.4241 -15	1.6024 -14	2.9042 -14	5.6176 -14

Table 7. (continued)

T(K)	v=1, J=4	v=1, J=5	v=1, J=6	v=1, J=7	v=1, J=8	v=1, J=9
4100	4.8731 -15	7.1669 -15	1.1331 -14	1.9141 -14	3.4440 -14	6.6086 -14
4200	5.8625 -15	8.5825 -15	1.3495 -14	2.2656 -14	4.0484 -14	7.7091 -14
4300	6.9880 -15	1.0185 -14	1.5932 -14	2.6589 -14	4.7201 -14	8.9228 -14
4400	8.2581 -15	1.1986 -14	1.8656 -14	3.0960 -14	5.4616 -14	1.0253 -13
4500	9.6812 -15	1.3996 -14	2.1680 -14	3.5785 -14	6.2750 -14	1.1701 -13
4600	1.1265 -14	1.6223 -14	2.5016 -14	4.1078 -14	7.1619 -14	1.3270 -13
4700	1.3016 -14	1.8676 -14	2.8673 -14	4.6852 -14	8.1238 -14	1.4961 -13
4800	1.4942 -14	2.1364 -14	3.2662 -14	5.3117 -14	9.1617 -14	1.6774 -13
4900	1.7047 -14	2.4292 -14	3.6990 -14	5.9882 -14	1.0276 -13	1.8709 -13
5000	1.9337 -14	2.7466 -14	4.1662 -14	6.7151 -14	1.1468 -13	2.0766 -13
5500	3.3683 -14	4.7156 -14	7.0312 -14	1.1114 -13	1.8573 -13	3.2833 -13
6000	5.2989 -14	7.3295 -14	1.0773 -13	1.6753 -13	2.7495 -13	4.7639 -13
6500	7.7122 -14	1.0559 -13	1.5332 -13	2.3516 -13	3.8008 -13	6.4741 -13
7000	1.0564 -13	1.4337 -13	2.0602 -13	3.1226 -13	4.9809 -13	8.3613 -13
7500	1.3790 -13	1.8573 -13	2.6448 -13	3.9678 -13	6.2572 -13	1.0371 -12
8000	1.7317 -13	2.3168 -13	3.2730 -13	4.8662 -13	7.5975 -13	1.2454 -12
8500	2.1068 -13	2.8021 -13	3.9309 -13	5.7978 -13	8.9724 -13	1.4564 -12
9000	2.4970 -13	3.3036 -13	4.6055 -13	6.7449 -13	1.0356 -12	1.6664 -12
9500	2.8955 -13	3.8128 -13	5.2858 -13	7.6922 -13	1.1728 -12	1.8724 -12
10000	3.2965 -13	4.3224 -13	5.9622 -13	8.6270 -13	1.3070 -12	2.0720 -12
11000	4.0864 -13	5.3191 -13	7.2732 -13	1.0420 -12	1.5614 -12	2.4453 -12
12000	4.8365 -13	6.2570 -13	8.4936 -13	1.2068 -12	1.7918 -12	2.7778 -12
13000	5.5281 -13	7.1146 -13	9.5983 -13	1.3543 -12	1.9952 -12	3.0665 -12
14000	6.1513 -13	7.8814 -13	1.0577 -12	1.4834 -12	2.1708 -12	3.3118 -12
15000	6.7027 -13	8.5546 -13	1.1427 -12	1.5943 -12	2.3197 -12	3.5162 -12
16000	7.1827 -13	9.1362 -13	1.2155 -12	1.6881 -12	2.4437 -12	3.6834 -12
17000	7.5947 -13	9.6313 -13	1.2768 -12	1.7661 -12	2.5452 -12	3.8173 -12
18000	7.9433 -13	1.0047 -12	1.3277 -12	1.8298 -12	2.6265 -12	3.9219 -12
19000	8.2340 -13	1.0389 -12	1.3691 -12	1.8808 -12	2.6900 -12	4.0008 -12
20000	8.4723 -13	1.0667 -12	1.4021 -12	1.9206 -12	2.7381 -12	4.0577 -12
21000	8.6640 -13	1.0887 -12	1.4277 -12	1.9505 -12	2.7726 -12	4.0957 -12
22000	8.8142 -13	1.1056 -12	1.4468 -12	1.9719 -12	2.7956 -12	4.1175 -12
23000	8.9278 -13	1.1181 -12	1.4602 -12	1.9859 -12	2.8086 -12	4.1255 -12
24000	9.0094 -13	1.1266 -12	1.4688 -12	1.9935 -12	2.8131 -12	4.1220 -12
25000	9.0630 -13	1.1318 -12	1.4731 -12	1.9957 -12	2.8104 -12	4.1087 -12
26000	9.0923 -13	1.1340 -12	1.4738 -12	1.9932 -12	2.8016 -12	4.0872 -12
27000	9.1004 -13	1.1337 -12	1.4713 -12	1.9867 -12	2.7876 -12	4.0588 -12
28000	9.0903 -13	1.1312 -12	1.4662 -12	1.9769 -12	2.7692 -12	4.0248 -12
29000	9.0644 -13	1.1268 -12	1.4588 -12	1.9642 -12	2.7473 -12	3.9862 -12
30000	9.0251 -13	1.1209 -12	1.4494 -12	1.9491 -12	2.7223 -12	3.9438 -12

Table 8. Rate constant for hydrogen molecule in  $v=1$  and  $J=10-15$  states.

T(K)	$v=1, J=10$	$v=1, J=11$	$v=1, J=12$	$v=1, J=13$	$v=1, J=14$	$v=1, J=15$
100	---	---	---	---	---	---
200	---	---	---	---	---	---
300	---	---	---	---	---	---
400	---	---	---	---	---	---
500	---	---	---	---	1.1418 -28	6.7321 -27
600	---	1.1959 -29	2.5823 -28	6.5013 -27	1.8552 -25	6.0008 -24
700	6.0711 -28	7.6075 -27	1.1242 -25	1.9017 -24	3.5861 -23	7.5530 -22
800	9.9176 -26	9.5130 -25	1.0577 -23	1.3277 -22	1.8352 -21	2.8015 -20
900	5.1670 -24	4.0260 -23	3.5876 -22	3.5706 -21	3.8763 -20	4.6067 -19
1000	1.2106 -22	7.9875 -22	5.9625 -21	4.9283 -20	4.4103 -19	4.2898 -18
1100	1.5869 -21	9.1390 -21	5.9017 -20	4.1902 -19	3.2015 -18	2.6431 -17
1200	1.3465 -20	6.9230 -20	3.9619 -19	2.4782 -18	1.6598 -17	1.1953 -16
1300	8.1779 -20	3.8200 -19	1.9737 -18	1.1090 -17	6.6443 -17	4.2624 -16
1400	3.8205 -19	1.6437 -18	7.7800 -18	3.9875 -17	2.1713 -16	1.2615 -15
1500	1.4472 -18	5.7979 -18	2.5435 -17	1.2037 -16	6.0340 -16	3.2169 -15
1600	4.6241 -18	1.7405 -17	7.1442 -17	3.1532 -16	1.4701 -15	7.2699 -15
1700	1.2844 -17	4.5755 -17	1.7711 -16	7.3502 -16	3.2147 -15	1.4876 -14
1800	3.1753 -17	1.0771 -16	3.9573 -16	1.5548 -15	6.4245 -15	2.8026 -14
1900	7.1169 -17	2.3106 -16	8.1020 -16	3.0310 -15	1.1903 -14	4.9257 -14
2000	1.4677 -16	4.5809 -16	1.5402 -15	5.5132 -15	2.0682 -14	8.1615 -14
2100	2.8188 -16	8.4891 -16	2.7476 -15	9.4504 -15	3.4014 -14	1.2858 -13
2200	5.0907 -16	1.4842 -15	4.6404 -15	1.5392 -14	5.3351 -14	1.9393 -13
2300	8.7158 -16	2.4669 -15	7.4731 -15	2.3979 -14	8.0306 -14	2.8168 -13
2400	1.4242 -15	3.9230 -15	1.1545 -14	3.5935 -14	1.1661 -13	3.9586 -13
2500	2.2339 -15	6.0010 -15	1.7196 -14	5.2047 -14	1.6407 -13	5.4043 -13
2600	3.3790 -15	8.8702 -15	2.4800 -14	7.3148 -14	2.2449 -13	7.1918 -13
2700	4.9496 -15	1.2718 -14	3.4757 -14	1.0009 -13	2.9965 -13	9.3558 -13
2800	7.0452 -15	1.7747 -14	4.7483 -14	1.3374 -13	3.9126 -13	1.1927 -12
2900	9.7739 -15	2.4169 -14	6.3404 -14	1.7492 -13	5.0088 -13	1.4933 -12
3000	1.3250 -14	3.2204 -14	8.2943 -14	2.2444 -13	6.2995 -13	1.8394 -12
3100	1.7593 -14	4.2074 -14	1.0651 -13	2.8306 -13	7.7972 -13	2.2329 -12
3200	2.2924 -14	5.3997 -14	1.3451 -13	3.5144 -13	9.5124 -13	2.6749 -12
3300	2.9363 -14	6.8186 -14	1.6730 -13	4.3020 -13	1.1454 -12	3.1660 -12
3400	3.7031 -14	8.4846 -14	2.0522 -13	5.1987 -13	1.3627 -12	3.7066 -12
3500	4.6041 -14	1.0417 -13	2.4858 -13	6.2086 -13	1.6038 -12	4.2964 -12
3600	5.6505 -14	1.2632 -13	2.9764 -13	7.3352 -13	1.8688 -12	4.9349 -12
3700	6.8525 -14	1.5147 -13	3.5262 -13	8.5810 -13	2.1577 -12	5.6210 -12
3800	8.2194 -14	1.7975 -13	4.1370 -13	9.9476 -13	2.4705 -12	6.3534 -12
3900	9.7598 -14	2.1128 -13	4.8103 -13	1.1436 -12	2.8068 -12	7.1307 -12
4000	1.1481 -13	2.4615 -13	5.5469 -13	1.3045 -12	3.1662 -12	7.9509 -12

Table 8. (continued)

T(K)	v=1, J=10	v=1, J=11	v=1, J=12	v=1, J=13	v=1, J=14	v=1, J=15
4100	1.3390 -13	2.8445 -13	6.3475 -13	1.4775 -12	3.5481 -12	8.8120 -12
4200	1.5492 -13	3.2622 -13	7.2121 -13	1.6624 -12	3.9518 -12	9.7120 -12
4300	1.7790 -13	3.7151 -13	8.1405 -13	1.8590 -12	4.3766 -12	1.0648 -11
4400	2.0289 -13	4.2032 -13	9.1322 -13	2.0669 -12	4.8214 -12	1.1619 -11
4500	2.2989 -13	4.7266 -13	1.0186 -12	2.2859 -12	5.2854 -12	1.2621 -11
4600	2.5893 -13	5.2850 -13	1.1302 -12	2.5156 -12	5.7675 -12	1.3652 -11
4700	2.9001 -13	5.8780 -13	1.2476 -12	2.7555 -12	6.2667 -12	1.4710 -11
4800	3.2310 -13	6.5051 -13	1.3709 -12	3.0053 -12	6.7819 -12	1.5792 -11
4900	3.5821 -13	7.1656 -13	1.4999 -12	3.2643 -12	7.3119 -12	1.6895 -11
5000	3.9529 -13	7.8588 -13	1.6342 -12	3.5322 -12	7.8557 -12	1.8017 -11
5500	6.0899 -13	1.1779 -12	2.3787 -12	4.9857 -12	1.0741 -11	2.3835 -11
6000	8.6471 -13	1.6346 -12	3.2212 -12	6.5807 -12	1.3806 -11	2.9804 -11
6500	1.1538 -12	2.1390 -12	4.1290 -12	8.2540 -12	1.6931 -11	3.5710 -11
7000	1.4669 -12	2.6744 -12	5.0717 -12	9.9510 -12	2.0023 -11	4.1393 -11
7500	1.7949 -12	3.2254 -12	6.0229 -12	1.1628 -11	2.3009 -11	4.6748 -11
8000	2.1296 -12	3.7787 -12	6.9616 -12	1.3251 -11	2.5839 -11	5.1708 -11
8500	2.4643 -12	4.3238 -12	7.8715 -12	1.4797 -11	2.8482 -11	5.6238 -11
9000	2.7933 -12	4.8524 -12	8.7406 -12	1.6249 -11	3.0919 -11	6.0327 -11
9500	3.1122 -12	5.3584 -12	9.5610 -12	1.7597 -11	3.3142 -11	6.3978 -11
10000	3.4179 -12	5.8376 -12	1.0327 -11	1.8838 -11	3.5151 -11	6.7206 -11
11000	3.9812 -12	6.7058 -12	1.1689 -11	2.0993 -11	3.8550 -11	7.2489 -11
12000	4.4733 -12	7.4476 -12	1.2823 -11	2.2734 -11	4.1190 -11	7.6387 -11
13000	4.8925 -12	8.0658 -12	1.3743 -11	2.4099 -11	4.3171 -11	7.9126 -11
14000	5.2419 -12	8.5692 -12	1.4470 -11	2.5136 -11	4.4594 -11	8.0915 -11
15000	5.5272 -12	8.9696 -12	1.5029 -11	2.5894 -11	4.5553 -11	8.1935 -11
16000	5.7550 -12	9.2796 -12	1.5442 -11	2.6417 -11	4.6131 -11	8.2343 -11
17000	5.9324 -12	9.5115 -12	1.5733 -11	2.6745 -11	4.6399 -11	8.2265 -11
18000	6.0659 -12	9.6766 -12	1.5921 -11	2.6912 -11	4.6419 -11	8.1807 -11
19000	6.1617 -12	9.7851 -12	1.6022 -11	2.6948 -11	4.6240 -11	8.1053 -11
20000	6.2253 -12	9.8460 -12	1.6052 -11	2.6876 -11	4.5902 -11	8.0072 -11
21000	6.2617 -12	9.8672 -12	1.6024 -11	2.6719 -11	4.5440 -11	7.8920 -11
22000	6.2751 -12	9.8552 -12	1.5948 -11	2.6493 -11	4.4882 -11	7.7640 -11
23000	6.2692 -12	9.8158 -12	1.5832 -11	2.6212 -11	4.4250 -11	7.6268 -11
24000	6.2472 -12	9.7539 -12	1.5686 -11	2.5888 -11	4.3562 -11	7.4832 -11
25000	6.2118 -12	9.6736 -12	1.5514 -11	2.5530 -11	4.2833 -11	7.3354 -11
26000	6.1654 -12	9.5784 -12	1.5322 -11	2.5148 -11	4.2076 -11	7.1853 -11
27000	6.1099 -12	9.4711 -12	1.5115 -11	2.4747 -11	4.1300 -11	7.0343 -11
28000	6.0469 -12	9.3543 -12	1.4896 -11	2.4333 -11	4.0513 -11	6.8834 -11
29000	5.9781 -12	9.2301 -12	1.4668 -11	2.3910 -11	3.9721 -11	6.7335 -11
30000	5.9045 -12	9.1002 -12	1.4434 -11	2.3482 -11	3.8930 -11	6.5854 -11

Table 9. Rate constant for hydrogen molecule in  $v=1$  and  $J=16-21$  states.

T(K)	$v=1, J=16$	$v=1, J=17$	$v=1, J=18$	$v=1, J=19$	$v=1, J=20$	$v=1, J=21$
100	---	---	---	---	---	---
200	---	---	---	---	---	1.5954 -27
300	---	---	---	6.3976 -27	5.5163 -24	5.9505 -21
400	3.9404 -29	7.4506 -27	1.4779 -24	2.9739 -22	5.2883 -20	1.0943 -17
500	4.3193 -25	3.1507 -23	2.3908 -21	1.8208 -19	1.2555 -17	9.6565 -16
600	2.0843 -22	8.0571 -21	3.2222 -19	1.2848 -17	4.7109 -16	1.8748 -14
700	1.6926 -20	4.1573 -19	1.0523 -17	2.6442 -16	6.1745 -15	1.5361 -13
800	4.5200 -19	7.9011 -18	1.4192 -16	2.5231 -15	4.2004 -14	7.3501 -13
900	5.7565 -18	7.7243 -17	1.0625 -15	1.4437 -14	1.8474 -13	2.4598 -12
1000	4.3694 -17	4.7453 -16	5.2729 -15	5.7795 -14	5.9915 -13	6.4138 -12
1100	2.2776 -16	2.0805 -15	1.9415 -14	1.7852 -13	1.5579 -12	1.3954 -11
1200	8.9601 -16	7.0860 -15	5.7170 -14	4.5415 -13	3.4338 -12	2.6516 -11
1300	2.8397 -15	1.9879 -14	1.4181 -13	9.9547 -13	6.6666 -12	4.5416 -11
1400	7.5962 -15	4.7900 -14	3.0748 -13	1.9415 -12	1.1718 -11	7.1710 -11
1500	1.7746 -14	1.0222 -13	5.9882 -13	3.4496 -12	1.9028 -11	1.0611 -10
1600	3.7146 -14	1.9766 -13	1.0689 -12	5.6832 -12	2.8973 -11	1.4898 -10
1700	7.1039 -14	3.5250 -13	1.7764 -12	8.7993 -12	4.1848 -11	2.0033 -10
1800	1.2602 -13	5.8767 -13	2.7814 -12	1.2939 -11	5.7850 -11	2.5990 -10
1900	2.0989 -13	9.2584 -13	4.1427 -12	1.8218 -11	7.7079 -11	3.2719 -10
2000	3.3132 -13	1.3902 -12	5.9142 -12	2.4726 -11	9.9545 -11	4.0154 -10
2100	4.9958 -13	2.0035 -12	8.1425 -12	3.2521 -11	1.2517 -10	4.8217 -10
2200	7.2410 -13	2.7869 -12	1.0865 -11	4.1631 -11	1.5383 -10	5.6825 -10
2300	1.0141 -12	3.7594 -12	1.4111 -11	5.2056 -11	1.8532 -10	6.5891 -10
2400	1.3784 -12	4.9371 -12	1.7899 -11	6.3773 -11	2.1941 -10	7.5331 -10
2500	1.8250 -12	6.3328 -12	2.2236 -11	7.6735 -11	2.5585 -10	8.5062 -10
2600	2.3608 -12	7.9559 -12	2.7123 -11	9.0881 -11	2.9436 -10	9.5007 -10
2700	2.9916 -12	9.8127 -12	3.2551 -11	1.0613 -10	3.3466 -10	1.0509 -09
2800	3.7220 -12	1.1906 -11	3.8504 -11	1.2240 -10	3.7648 -10	1.1525 -09
2900	4.5554 -12	1.4235 -11	4.4961 -11	1.3960 -10	4.1954 -10	1.2543 -09
3000	5.4937 -12	1.6796 -11	5.1895 -11	1.5762 -10	4.6358 -10	1.3557 -09
3100	6.5380 -12	1.9585 -11	5.9275 -11	1.7637 -10	5.0835 -10	1.4562 -09
3200	7.6879 -12	2.2592 -11	6.7069 -11	1.9575 -10	5.5362 -10	1.5556 -09
3300	8.9420 -12	2.5810 -11	7.5240 -11	2.1566 -10	5.9917 -10	1.6533 -09
3400	1.0298 -11	2.9225 -11	8.3753 -11	2.3600 -10	6.4481 -10	1.7491 -09
3500	1.1753 -11	3.2827 -11	9.2569 -11	2.5669 -10	6.9036 -10	1.8427 -09
3600	1.3304 -11	3.6601 -11	1.0165 -10	2.7763 -10	7.3565 -10	1.9340 -09
3700	1.4945 -11	4.0534 -11	1.1097 -10	2.9876 -10	7.8055 -10	2.0228 -09
3800	1.6672 -11	4.4612 -11	1.2048 -10	3.1998 -10	8.2492 -10	2.1090 -09
3900	1.8480 -11	4.8820 -11	1.3015 -10	3.4124 -10	8.6866 -10	2.1924 -09
4000	2.0364 -11	5.3144 -11	1.3994 -10	3.6246 -10	9.1166 -10	2.2729 -09

Table 9. (continued)

T(K)	v=1, J=16	v=1, J=17	v=1, J=18	v=1, J=19	v=1, J=20	v=1, J=21
4100	2.2317 -11	5.7571 -11	1.4983 -10	3.8359 -10	9.5385 -10	2.3506 -09
4200	2.4333 -11	6.2085 -11	1.5979 -10	4.0457 -10	9.9514 -10	2.4254 -09
4300	2.6408 -11	6.6674 -11	1.6979 -10	4.2536 -10	1.0355 -09	2.4972 -09
4400	2.8535 -11	7.1324 -11	1.7980 -10	4.4592 -10	1.0748 -09	2.5661 -09
4500	3.0708 -11	7.6023 -11	1.8980 -10	4.6620 -10	1.1132 -09	2.6322 -09
4600	3.2922 -11	8.0759 -11	1.9976 -10	4.8617 -10	1.1504 -09	2.6953 -09
4700	3.5171 -11	8.5520 -11	2.0967 -10	5.0581 -10	1.1865 -09	2.7557 -09
4800	3.7450 -11	9.0297 -11	2.1951 -10	5.2508 -10	1.2216 -09	2.8132 -09
4900	3.9753 -11	9.5079 -11	2.2925 -10	5.4397 -10	1.2555 -09	2.8680 -09
5000	4.2075 -11	9.9856 -11	2.3889 -10	5.6245 -10	1.2883 -09	2.9202 -09
5500	5.3821 -11	1.2339 -10	2.8508 -10	6.4833 -10	1.4353 -09	3.1433 -09
6000	6.5439 -11	1.4577 -10	3.2713 -10	7.2277 -10	1.5555 -09	3.3101 -09
6500	7.6566 -11	1.6644 -10	3.6445 -10	7.8580 -10	1.6512 -09	3.4295 -09
7000	8.6964 -11	1.8514 -10	3.9691 -10	8.3808 -10	1.7253 -09	3.5098 -09
7500	9.6495 -11	2.0174 -10	4.2467 -10	8.8056 -10	1.7808 -09	3.5583 -09
8000	1.0510 -10	2.1626 -10	4.4801 -10	9.1434 -10	1.8206 -09	3.5812 -09
8500	1.1275 -10	2.2879 -10	4.6732 -10	9.4049 -10	1.8472 -09	3.5836 -09
9000	1.1949 -10	2.3946 -10	4.8301 -10	9.6005 -10	1.8628 -09	3.5697 -09
9500	1.2535 -10	2.4842 -10	4.9548 -10	9.7395 -10	1.8693 -09	3.5430 -09
10000	1.3040 -10	2.5584 -10	5.0514 -10	9.8303 -10	1.8684 -09	3.5063 -09
11000	1.3829 -10	2.6665 -10	5.1737 -10	9.8956 -10	1.8492 -09	3.4118 -09
12000	1.4368 -10	2.7308 -10	5.2217 -10	9.8445 -10	1.8139 -09	3.2995 -09
13000	1.4707 -10	2.7611 -10	5.2149 -10	9.7125 -10	1.7684 -09	3.1783 -09
14000	1.4886 -10	2.7655 -10	5.1683 -10	9.5255 -10	1.7167 -09	3.0539 -09
15000	1.4940 -10	2.7504 -10	5.0932 -10	9.3024 -10	1.6618 -09	2.9299 -09
16000	1.4898 -10	2.7209 -10	4.9983 -10	9.0569 -10	1.6054 -09	2.8086 -09
17000	1.4782 -10	2.6808 -10	4.8898 -10	8.7985 -10	1.5490 -09	2.6914 -09
18000	1.4610 -10	2.6331 -10	4.7726 -10	8.5344 -10	1.4934 -09	2.5790 -09
19000	1.4397 -10	2.5801 -10	4.6503 -10	8.2695 -10	1.4392 -09	2.4719 -09
20000	1.4153 -10	2.5236 -10	4.5254 -10	8.0072 -10	1.3868 -09	2.3702 -09
21000	1.3887 -10	2.4649 -10	4.4000 -10	7.7500 -10	1.3363 -09	2.2738 -09
22000	1.3606 -10	2.4052 -10	4.2753 -10	7.4995 -10	1.2879 -09	2.1827 -09
23000	1.3316 -10	2.3450 -10	4.1526 -10	7.2567 -10	1.2417 -09	2.0965 -09
24000	1.3021 -10	2.2851 -10	4.0323 -10	7.0224 -10	1.1975 -09	2.0152 -09
25000	1.2724 -10	2.2259 -10	3.9152 -10	6.7967 -10	1.1555 -09	1.9384 -09
26000	1.2428 -10	2.1676 -10	3.8014 -10	6.5799 -10	1.1154 -09	1.8658 -09
27000	1.2134 -10	2.1106 -10	3.6912 -10	6.3719 -10	1.0773 -09	1.7973 -09
28000	1.1845 -10	2.0550 -10	3.5848 -10	6.1725 -10	1.0410 -09	1.7325 -09
29000	1.1560 -10	2.0008 -10	3.4821 -10	5.9816 -10	1.0065 -09	1.6713 -09
30000	1.1281 -10	1.9483 -10	3.3831 -10	5.7989 -10	9.7369 -10	1.6133 -09

Table 10. Rate constant for hydrogen molecule in  $v=1$  and  $J=22-27$  states.

T(K)	$v=1, J=22$	$v=1, J=23$	$v=1, J=24$	$v=1, J=25$	$v=1, J=26$	$v=1, J=27$
100	---	---	2.3081 -23	3.4335 -16	9.3750 -12	1.9937 -10
200	3.9356 -23	2.8315 -19	4.2929 -16	4.2075 -13	5.2145 -11	7.4464 -10
300	5.5018 -18	1.7321 -15	1.6143 -13	9.1049 -12	2.1832 -10	1.9308 -09
400	1.9754 -15	1.3869 -13	3.6826 -12	6.3167 -11	6.7053 -10	3.8973 -09
500	6.5671 -14	1.9324 -12	2.5537 -11	2.3457 -10	1.5335 -09	6.5108 -09
600	6.6644 -13	1.1160 -11	9.4830 -11	5.9273 -10	2.8192 -09	9.5182 -09
700	3.4394 -12	3.8855 -11	2.4355 -10	1.1708 -09	4.4528 -09	1.2679 -08
800	1.1646 -11	9.8477 -11	4.9423 -10	1.9624 -09	6.3255 -09	1.5813 -08
900	2.9803 -11	2.0186 -10	8.5516 -10	2.9350 -09	8.3303 -09	1.8806 -08
1000	6.2724 -11	3.5659 -10	1.3219 -09	4.0442 -09	1.0378 -08	2.1588 -08
1100	1.1457 -10	5.6529 -10	1.8814 -09	5.2447 -09	1.2403 -08	2.4129 -08
1200	1.8823 -10	8.2627 -10	2.5162 -09	6.4956 -09	1.4356 -08	2.6416 -08
1300	2.8512 -10	1.1347 -09	3.2074 -09	7.7624 -09	1.6208 -08	2.8455 -08
1400	4.0527 -10	1.4838 -09	3.9369 -09	9.0183 -09	1.7941 -08	3.0257 -08
1500	5.4758 -10	1.8660 -09	4.6882 -09	1.0243 -08	1.9543 -08	3.1837 -08
1600	7.1009 -10	2.2735 -09	5.4475 -09	1.1421 -08	2.1013 -08	3.3214 -08
1700	8.9034 -10	2.6987 -09	6.2031 -09	1.2542 -08	2.2352 -08	3.4405 -08
1800	1.0856 -09	3.1350 -09	6.9457 -09	1.3600 -08	2.3564 -08	3.5428 -08
1900	1.2929 -09	3.5762 -09	7.6682 -09	1.4592 -08	2.4654 -08	3.6300 -08
2000	1.5096 -09	4.0174 -09	8.3651 -09	1.5516 -08	2.5630 -08	3.7036 -08
2100	1.7329 -09	4.4541 -09	9.0325 -09	1.6371 -08	2.6499 -08	3.7651 -08
2200	1.9605 -09	4.8828 -09	9.6678 -09	1.7159 -08	2.7269 -08	3.8158 -08
2300	2.1902 -09	5.3008 -09	1.0269 -08	1.7883 -08	2.7947 -08	3.8568 -08
2400	2.4200 -09	5.7057 -09	1.0836 -08	1.8544 -08	2.8541 -08	3.8892 -08
2500	2.6484 -09	6.0960 -09	1.1368 -08	1.9146 -08	2.9058 -08	3.9138 -08
2600	2.8738 -09	6.4704 -09	1.1865 -08	1.9692 -08	2.9503 -08	3.9317 -08
2700	3.0951 -09	6.8280 -09	1.2328 -08	2.0185 -08	2.9884 -08	3.9435 -08
2800	3.3114 -09	7.1683 -09	1.2758 -08	2.0628 -08	3.0206 -08	3.9499 -08
2900	3.5217 -09	7.4911 -09	1.3156 -08	2.1024 -08	3.0474 -08	3.9514 -08
3000	3.7255 -09	7.7964 -09	1.3524 -08	2.1378 -08	3.0692 -08	3.9487 -08
3100	3.9224 -09	8.0842 -09	1.3862 -08	2.1690 -08	3.0866 -08	3.9423 -08
3200	4.1119 -09	8.3549 -09	1.4171 -08	2.1965 -08	3.1000 -08	3.9325 -08
3300	4.2938 -09	8.6088 -09	1.4454 -08	2.2206 -08	3.1097 -08	3.9197 -08
3400	4.4680 -09	8.8463 -09	1.4712 -08	2.2414 -08	3.1160 -08	3.9043 -08
3500	4.6344 -09	9.0680 -09	1.4946 -08	2.2592 -08	3.1194 -08	3.8866 -08
3600	4.7929 -09	9.2744 -09	1.5158 -08	2.2742 -08	3.1199 -08	3.8668 -08
3700	4.9437 -09	9.4662 -09	1.5348 -08	2.2867 -08	3.1180 -08	3.8453 -08
3800	5.0867 -09	9.6438 -09	1.5519 -08	2.2969 -08	3.1139 -08	3.8222 -08
3900	5.2222 -09	9.8080 -09	1.5670 -08	2.3048 -08	3.1077 -08	3.7977 -08
4000	5.3503 -09	9.9593 -09	1.5804 -08	2.3108 -08	3.0997 -08	3.7721 -08

Table 10. (continued)

T(K)	v=1, J=22	v=1, J=23	v=1, J=24	v=1, J=25	v=1, J=26	v=1, J=27
4100	5.4712 -09	1.0098 -08	1.5922 -08	2.3149 -08	3.0901 -08	3.7454 -08
4200	5.5851 -09	1.0226 -08	1.6025 -08	2.3174 -08	3.0790 -08	3.7179 -08
4300	5.6921 -09	1.0342 -08	1.6113 -08	2.3182 -08	3.0665 -08	3.6896 -08
4400	5.7925 -09	1.0448 -08	1.6187 -08	2.3176 -08	3.0529 -08	3.6606 -08
4500	5.8866 -09	1.0544 -08	1.6249 -08	2.3157 -08	3.0382 -08	3.6311 -08
4600	5.9745 -09	1.0630 -08	1.6300 -08	2.3126 -08	3.0225 -08	3.6012 -08
4700	6.0566 -09	1.0707 -08	1.6339 -08	2.3084 -08	3.0059 -08	3.5709 -08
4800	6.1329 -09	1.0777 -08	1.6368 -08	2.3032 -08	2.9886 -08	3.5403 -08
4900	6.2038 -09	1.0838 -08	1.6388 -08	2.2971 -08	2.9707 -08	3.5095 -08
5000	6.2695 -09	1.0891 -08	1.6399 -08	2.2901 -08	2.9521 -08	3.4786 -08
5500	6.5276 -09	1.1061 -08	1.6343 -08	2.2448 -08	2.8528 -08	3.3233 -08
6000	6.6864 -09	1.1098 -08	1.6143 -08	2.1872 -08	2.7472 -08	3.1704 -08
6500	6.7678 -09	1.1040 -08	1.5848 -08	2.1226 -08	2.6398 -08	3.0226 -08
7000	6.7894 -09	1.0912 -08	1.5489 -08	2.0542 -08	2.5334 -08	2.8815 -08
7500	6.7655 -09	1.0735 -08	1.5090 -08	1.9845 -08	2.4297 -08	2.7478 -08
8000	6.7071 -09	1.0524 -08	1.4668 -08	1.9148 -08	2.3297 -08	2.6218 -08
8500	6.6231 -09	1.0290 -08	1.4236 -08	1.8464 -08	2.2341 -08	2.5033 -08
9000	6.5201 -09	1.0042 -08	1.3801 -08	1.7797 -08	2.1429 -08	2.3920 -08
9500	6.4036 -09	9.7864 -09	1.3370 -08	1.7153 -08	2.0564 -08	2.2877 -08
10000	6.2777 -09	9.5270 -09	1.2947 -08	1.6534 -08	1.9745 -08	2.1898 -08
11000	6.0095 -09	9.0107 -09	1.2134 -08	1.5374 -08	1.8236 -08	2.0121 -08
12000	5.7334 -09	8.5111 -09	1.1375 -08	1.4317 -08	1.6889 -08	1.8555 -08
13000	5.4599 -09	8.0368 -09	1.0672 -08	1.3359 -08	1.5686 -08	1.7171 -08
14000	5.1950 -09	7.5918 -09	1.0027 -08	1.2491 -08	1.4608 -08	1.5943 -08
15000	4.9419 -09	7.1770 -09	9.4340 -09	1.1705 -08	1.3642 -08	1.4850 -08
16000	4.7023 -09	6.7918 -09	8.8909 -09	1.0992 -08	1.2773 -08	1.3872 -08
17000	4.4767 -09	6.4349 -09	8.3931 -09	1.0344 -08	1.1988 -08	1.2994 -08
18000	4.2649 -09	6.1044 -09	7.9364 -09	9.7537 -09	1.1278 -08	1.2202 -08
19000	4.0666 -09	5.7984 -09	7.5168 -09	9.2151 -09	1.0633 -08	1.1487 -08
20000	3.8811 -09	5.5150 -09	7.1308 -09	8.7224 -09	1.0046 -08	1.0837 -08
21000	3.7076 -09	5.2521 -09	6.7751 -09	8.2706 -09	9.5095 -09	1.0245 -08
22000	3.5454 -09	5.0082 -09	6.4467 -09	7.8552 -09	9.0182 -09	9.7046 -09
23000	3.3936 -09	4.7815 -09	6.1429 -09	7.4726 -09	8.5670 -09	9.2094 -09
24000	3.2515 -09	4.5705 -09	5.8614 -09	7.1193 -09	8.1515 -09	8.7545 -09
25000	3.1183 -09	4.3739 -09	5.6001 -09	6.7923 -09	7.7681 -09	8.3353 -09
26000	2.9935 -09	4.1904 -09	5.3571 -09	6.4892 -09	7.4134 -09	7.9483 -09
27000	2.8763 -09	4.0189 -09	5.1307 -09	6.2075 -09	7.0845 -09	7.5900 -09
28000	2.7662 -09	3.8584 -09	4.9194 -09	5.9453 -09	6.7790 -09	7.2577 -09
29000	2.6626 -09	3.7080 -09	4.7220 -09	5.7007 -09	6.4946 -09	6.9487 -09
30000	2.5650 -09	3.5668 -09	4.5371 -09	5.4723 -09	6.2293 -09	6.6609 -09