

## Carbon (graphite)

## Hydrogen

$T$ K	C (graphite)			H <sub>2</sub> (g) <sup>a</sup>		
	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$
50	0.06094	0.03070	0.02050	4.5668	9.3372	3.2830
100	0.2013	0.1145	0.07161	3.3861	12.1148	3.6072
150	0.3884	0.2300	0.1448	3.1940	13.4304	3.4843
200	0.6021	0.3707	0.2322	3.3012	14.3621	3.4235
273.16	0.9192	0.6054	0.3739	3.4422	15.4150	3.4119
298.15	1.0244	0.6904	0.4240	3.4682	15.7173	3.4157
300	1.0320	0.6968	0.4277	3.4697	15.7387	3.4160
400	1.4213	1.0480	0.6283	3.5097	16.7439	3.4358
500	1.7588	1.4026	0.8218	3.5192	17.5283	3.4516
600	2.0259	1.7480	1.0012	3.5273	18.1705	3.4635
700	2.2295	2.0762	1.1628	3.5409	18.7152	3.4735
800	2.3846	2.3845	1.3062	3.5630	19.1984	3.4832
900	2.5045	2.6726	1.4330	3.5939	19.6107	3.4937
1000	2.5992	2.9416	1.5450	3.6328	19.9913	3.5056
1100	2.6754	3.1930	1.6444	3.6780	20.3397	3.5192
1200	2.7381	3.4286	1.7330	3.7275	20.6618	3.5345
1300	2.791	3.650	1.812	3.779	20.962	3.5513
1400	2.836	3.858	1.884	3.832	21.244	3.5695
1500	2.875	4.055	1.949	3.884	21.510	3.5887
1750	2.955	4.505	2.087	4.010	22.119	3.640
2000	3.018	4.904	2.200	4.123	22.662	3.694
2250	3.071	5.262	2.294	4.223	23.153	3.747
2500	3.118	5.588	2.374	4.311	23.603	3.799
2750	3.161	5.888	2.443	4.389	24.017	3.849
3000	3.20	6.16	2.50	4.461	24.402	3.897
3500	3.27	6.66	2.61	4.588	25.100	3.987
4000	3.34	7.10	2.70	4.705	25.720	4.069
4500	3.41	7.50	2.77	4.813	26.281	4.146
5000	3.48	7.86	2.84	4.911	26.793	4.218

<sup>a</sup>Equilibrium mixture of ortho- and para-H<sub>2</sub>(g)

## Oxygen

## Nitrogen

$T$ K	O <sub>2</sub> (g)			N <sub>2</sub> (g)		
	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$
50	3.5004	18.4179	3.4863	3.5003	16.7947	3.4810
100	3.5007	20.8442	3.4934	3.5004	19.2210	3.4907
150	3.5011	22.2637	3.4959	3.5006	20.6403	3.4940
200	3.5030	23.2710	3.4974	3.5008	21.6474	3.4956
273.16	3.5206	24.3656	3.5006	3.5018	22.7394	3.4971
298.15	3.5332	24.6737	3.5028	3.5029	23.0454	3.4975
300	3.5343	24.6955	3.5030	3.5030	23.0671	3.4976
400	3.6210	25.7230	3.5206	3.5179	24.0763	3.5003
500	3.7394	26.5435	3.5523	3.5577	24.8651	3.5074
600	3.8595	27.2360	3.5936	3.6214	25.5191	3.5208
700	3.9667	27.8392	3.6394	3.6989	26.0831	3.5406
800	4.0572	28.3749	3.6862	3.7806	26.5823	3.5656
900	4.1320	28.8573	3.7317	3.8596	27.0323	3.5939
1000	4.1939	29.2959	3.7749	3.9325	27.4427	3.6242
1100	4.2456	29.6981	3.8154	3.9981	27.8207	3.6552
1200	4.2898	30.0695	3.8532	4.0560	28.1711	3.6863
1300	4.3284	30.4144	3.8883	4.1070	28.4978	3.7167
1400	4.3632	30.7365	3.9210	4.1516	28.8038	3.7462
1500	4.3953	31.0386	3.9515	4.1906	29.0916	3.7746
1750	4.4692	31.7218	4.0203	4.2687	29.7438	3.8399
2000	4.5392	32.3232	4.0808	4.3263	30.3177	3.8973
2250	4.6074	32.8617	4.1355	4.3698	30.8299	3.9474
2500	4.6733	33.3506	4.1860	4.4039	31.2922	3.9915
2750	4.7361	33.7990	4.2332	4.4312	31.7132	4.0302
3000	4.7946	34.2136	4.2776	4.4537	32.0998	4.0646
3500	4.8971	34.9607	4.3590	4.4890	32.7891	4.1228
4000	4.9818	35.6203	4.4317	4.5163	33.3904	4.1704
4500	5.0565	36.2114	4.4970	4.5388	33.9237	4.2101
5000	5.1327	36.7481	4.5567	4.5598	34.4030	4.2440

## Deuterium

## Sulfur

$T$ K	$D_2(g)^b$			$S(cr, \ell, g)^c$		
	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$
50	3.4914	11.0453	2.9718	0.90228	0.67181	0.41932
100	3.6464	13.5654	3.3080	1.5358	1.5060	0.82967
150	3.5378	15.0139	3.3998	1.9973	2.2201	1.1454
200	3.5125	16.0331	3.4302	2.3294	2.8429	1.4022
273.16	3.5104	17.1281	3.4517	2.6481	3.6201	1.6965
298.15	3.5113	17.4348	3.4567	2.7300	3.8555	1.7798
300	3.5113	17.4565	3.4570	2.7355	3.8724	1.7857
400	3.5170	18.4673	3.4712	3.8683	5.3873	2.7215
500	3.5319	19.2535	3.4816	4.5687	6.4385	3.1220
600	3.5624	19.8999	3.4923	4.1263	7.2259	3.3203
700	3.6091	20.4523	3.5055	3.9307	7.8467	3.4211
800	3.6685	20.9380	3.5220	3.8125	8.3626	3.4762
900	3.7353	21.3739	3.5420	2.2230	16.0502	10.6006
1000	3.8050	21.7711	3.5648	2.2417	16.2854	9.7638
1100	3.8740	22.1370	3.5898	2.2602	16.4999	9.0807
1200	3.9404	22.4769	3.6163	2.2788	16.6974	8.5131
1300	4.0029	22.7948	3.6441	2.2975	16.8805	8.0343
1400	4.0611	23.0936	3.6714	2.3161	17.0515	7.6252
1500	4.1149	23.3757	3.6992	2.3344	17.2119	7.2719
1750	4.231	24.019	3.767	2.3771	17.5750	6.5697
2000	4.327	24.591	3.831	2.4141	17.8949	6.0479
2250	4.406	25.105	3.891	2.4439	18.1810	5.6459
2500	4.474	25.573	3.946	2.4687	18.4399	5.3270
2750	4.534	26.002	3.997	2.4871	18.6760	5.0680
3000	4.589	26.399	4.044	2.5033	18.8931	4.8536
3500	4.690	27.114	4.129	2.5288	19.2809	4.5197
4000	4.785	27.746	4.205	2.5546	19.6202	4.2724
4500	4.877	28.315	4.275	2.5857	19.9229	4.0832
5000	4.963	28.834	4.339	2.6231	20.1972	3.9353

<sup>a</sup>The thermal functions for  $S(cr, \ell, g)$  are taken from the JANAF Thermochemical Tables, 3rd. ed., 1985, the last column values for  $S_2(g)$  are evaluated based on  $\Delta_f H^0(298.15 \text{ K}) = 128.49 \text{ kJ mol}^{-1}$  which is the 1978 CODATA value and will be adopted by JANAF Tables in the future

<sup>b</sup>Equilibrium mixture of ortho- and para- $D_2(g)$

<sup>c</sup> $S(cr, II)$ , 0 K - 368.30 K;  $S(cr, I)$ , 368.30 K - 388.36 K;  $S(\ell)$ , 388.36 K - 881.21 K; and  $S_2(g)$ , 881.21 K - 5000 K

## Fluorine

## Chlorine

$T$ K	F <sub>2</sub> (g)			Cl <sub>2</sub> (g)		
	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$
50	3.5006	18.0643	3.4918	3.5005	20.3028	3.4979
100	3.5016	20.4910	3.4964	3.5238	22.7325	3.5022
150	3.5159	21.9125	3.4997	3.6457	24.1811	3.5271
200	3.5703	22.9303	3.5096	3.8151	25.2530	3.5778
273.16	3.7107	24.0635	3.5438	4.0268	26.4759	3.6713
298.15	3.7648	24.3901	3.5600	4.0831	26.8304	3.7035
300	3.7688	24.4134	3.5612	4.0870	26.8557	3.7059
400	3.9681	25.5259	3.6389	4.2452	28.0552	3.8228
500	4.1199	26.4286	3.7207	4.3375	29.0133	3.9173
600	4.2295	27.1899	3.7969	4.3955	29.8096	3.9925
700	4.3097	27.8483	3.8647	4.4348	30.4903	4.0530
800	4.3703	28.4279	3.9243	4.4632	31.0845	4.1026
900	4.4179	28.9455	3.9766	4.4851	31.6115	4.1439
1000	4.4570	29.4130	4.0227	4.5028	32.0849	4.1790
1100	4.4903	29.8394	4.0637	4.5177	32.5148	4.2091
1200	4.5198	30.2314	4.1005	4.5309	32.9085	4.2354
1300	4.5466	30.5943	4.1338	4.5429	33.2716	4.2586
1400	4.5714	30.9321	4.1642	4.5541	33.6087	4.2793
1500	4.5943	31.2483	4.1921	4.5648	33.9233	4.2980
1750	4.6425	31.9603	4.2532	4.5916	34.6290	4.3380
2000	4.6722	32.5824	4.3039	4.6218	35.2440	4.3715
2250	4.6767	33.1332	4.3454	4.6595	35.7904	4.4013
2500	4.6534	33.6250	4.3776	4.7065	36.2837	4.4294
2750	4.6036	34.0664	4.4006	4.7615	36.7348	4.4571
3000	4.5322	34.4640	4.4146	4.8200	37.1516	4.4849
3500	4.3482	35.1494	4.4188	4.9222	37.9028	4.5405
4000	4.1437	35.7167	4.3972	4.9679	38.5638	4.5918
4500	3.9458	36.1932	4.3579	4.9374	39.1480	4.6326
5000	3.7670	36.5995	4.3076	4.8381	39.6635	4.6586

## Bromine

## Iodine

$T$ K	$\text{Br}_2(\text{cr}, \ell, \text{g})^{\text{a}}$			$\text{I}_2(\text{cr}, \ell, \text{g})^{\text{b}}$		
	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$	$\frac{C_p^0}{R}$	$\frac{S^0(T) - S^0(0)}{R}$	$\frac{H^0(T) - H^0(0)}{RT}$
50	4.009	3.253	1.999	4.313	3.888	2.293
100	5.242	6.476	3.359	5.490	7.336	3.668
150	5.914	8.737	4.105	5.964	9.670	4.370
200	6.466	10.514	4.627	6.202	11.421	4.800
273.16	9.270	17.506	9.954	6.457	13.399	5.215
298.15	9.101	18.306	9.887	6.547	13.969	5.324
300	9.095	18.362	9.882	6.556	14.009	5.332
400	4.417	30.801	17.779	9.702	20.935	10.505
500	4.459	31.791	15.111	4.506	33.666	19.997
600	4.486	32.607	13.338	4.524	34.490	17.417
700	4.505	33.300	12.075	4.538	35.188	15.576
800	4.521	33.903	11.130	4.552	35.795	14.197
900	4.533	34.436	10.396	4.565	36.332	13.126
1000	4.545	34.914	9.810	4.580	36.814	12.271
1100	4.555	35.348	9.332	4.598	37.251	11.573
1200	4.566	35.744	8.935	4.622	37.652	10.992
1300	4.576	36.110	8.599	4.654	38.023	10.503
1400	4.587	36.450	8.312	4.697	38.370	10.087
1500	4.599	36.767	8.064	4.752	38.695	9.729
1750	4.635	37.478	7.555	4.932	39.441	9.031
2000	4.684	38.100	7.207	5.141	40.113	8.531
2250	4.745	38.655	6.930	5.323	40.730	8.165
2500	4.813	39.159	6.715	5.433	41.297	7.887
2750	4.879	39.621	6.545	5.456	41.816	7.666
3000	4.936	40.048	6.409	5.400	42.289	7.480
3500	4.997	40.814	6.204	5.130	43.103	7.165
4000	4.980	41.481	6.053	4.779	43.766	6.889
4500	4.903	42.064	5.929	4.438	44.309	6.635
5000	4.784	42.574	5.821	4.143	44.760	6.400

<sup>a</sup> $\text{Br}_2(\text{cr})$ , 0-265.90 K;  $\text{Br}_2(\ell)$ , 265.90-332.503 K;  $\text{Br}_2(\text{g})$ , 332.503-5000 K.

<sup>b</sup> $\text{I}_2(\text{cr})$ , 0-386.75 K;  $\text{I}_2(\ell)$ , 386.75-457.666 K;  $\text{I}_2(\text{g})$ , 457.666-5000 K.