

## 4h. Thermodynamic Properties of Gases

JOSEPH HILSEN RATH

*The National Bureau of Standards*

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**4h-1. Thermodynamic Properties of Nonionized Gases.** The thermodynamic properties of air, argon, hydrogen, nitrogen, oxygen at temperatures below 3000 K (Tables 4h-3 through 4h-27) are an abridged version of a collection of tables computed and published at the National Bureau of Standards [1]. The tables of compressibility and density were computed from equations of state which were fitted to the existing *PVT* data. In most instances the method of fitting permitted simultaneous consideration of other experimental data, such as Joule-Thomson coefficients, specific heat, and sound-velocity measurements. The tables for entropy, enthalpy, and specific heats were obtained by combining these properties of the ideal

gas with corrections for the gas imperfection obtained, through the thermodynamic identities, from the equation of state. A fuller discussion and more extensive tabulations in the temperature argument are to be found in the above-cited circular of the National Bureau of Standards.

The tables are presented in dimensionless form. Conversion factors given in Tables 4h-1 and 4h-2 permit ready conversion to some of the more frequently used units. Values of the gas constant  $R$  are listed for frequently used units in order to facilitate the use of the tables of the compressibility factor in calculating, by means of the equation  $Z = PV/RT$ , the pressure  $P$ , the specific volume  $V$  (or density  $1/V$ ), or the temperature  $T$ , when any two of these are known. The molecular weights given in Table 4h-2 permit extension of the tabulated values of  $R$  to still other units.

Pressure entries have been chosen to facilitate four-point Lagrangian interpolation, when linear interpolation is not valid. A convenient rule of thumb for determining the adequacy of linear interpolation is the following: "The error introduced by linear interpolation is approximately  $\frac{1}{8}$  of the second difference." Where this error greatly exceeds the uncertainty of the table, nonlinear interpolation is recommended.

**4h-2. Thermodynamic Properties of Ionized Gases.** The thermodynamic properties of air, nitrogen, and argon are given in Tables 4h-28, 4h-29, and 4h-30. The properties are given for one mole of low-temperature gas whose molecules, atoms, and ions are in chemical equilibrium with the electrons. The tables include the effect of second virial forces and the limiting-law Debye-Huckel effect upon both the equilibrium compositions and the thermodynamic properties of the mixture.

The tables for air are given at 2000 K intervals from 4000 to 14,000 K at uniform intervals in  $\log(\rho/\rho_0)$  from  $-5$ . to 2. They contain the dimensionless quantities: compressibility factor,  $Z = PV/RT$ ; internal energy,  $E/RT$ ; enthalpy,  $H/RT$ ; entropy,  $S/R$ ; the logarithm of the pressure,  $\log_{10} P_{\text{atm}}$ ; and  $Z^*$ , the number of moles of dissociated gas per mole of low-temperature (undissociated) air. The data are taken from more extensive tables by Hilsenrath and Klein [2] who present the equilibrium composition in addition to the above-enumerated properties, and the equations from which the tables were computed.

The tables for nitrogen and argon contain, in addition, the specific heat at constant pressure,  $c_p/R$ ; the specific heat at constant volume,  $c_v/R$ ; and the sound velocity ratio,  $a/a_0$ . These tables are from a more extensive set by Hilsenrath, Messina, Klein, and Thompson [3], to which the reader is referred for a detailed discussion of the computation of equilibrium properties of a gas mixture undergoing dissociation and ionization under the influence of both ionic and virial forces.

Table 4h-31 gives  $Z^* = PV/RT$ ,  $E^*/RT$ ,  $P$  (atm), and  $\rho/\rho_0$  for highly ionized air, nitrogen, and oxygen as a function of the electron concentration  $C_e$  and temperature\*

TABLE 4h-1. VALUES OF THE GAS CONSTANT  $R$  IN VARIOUS UNITS

$P$	$V$	$T$	$R$
N/m <sup>2</sup> .....	m <sup>3</sup> /mole	K	8.3143 Nm/mole·K
atm.....	cm <sup>3</sup> /mole	K	82.0567 atm cm <sup>3</sup> /mole·K
kg/cm <sup>2</sup> .....	cm <sup>3</sup> /mole	K	84.7832 (kg/cm <sup>2</sup> )cm <sup>3</sup> /mole·K
bars.....	cm <sup>3</sup> /mole	K	83.1440 bars cm <sup>3</sup> /mole·K
mm Hg.....	cm <sup>3</sup> /mole	K	62,363.1 (mm Hg)cm <sup>3</sup> /mole·K
atm.....	liters/mole	K	0.0820544 atm liters/mole·K
kg/cm <sup>2</sup> .....	liters/mole	K	0.0847809 (kg/cm <sup>2</sup> ) liters/mole·K
mm Hg.....	liters/mole	K	62.3613 (mm Hg) liters/mole·K
atm.....	ft <sup>3</sup> (lb)mole	°R	0.730228 atm ft <sup>3</sup> /mole °R
mm Hg.....	ft <sup>3</sup> (lb)mole	°R	554.973 (mm Hg) ft <sup>3</sup> /mole °R

\* Concluded on page 4-204.

TABLE 4h-2. CONVERSION FACTORS FOR TABLES 4h-4 THROUGH 4h-30

To convert tabulated value of	To	Having the dimensions indicated below	Air	Argon	CO <sub>2</sub>	H <sub>2</sub>	N <sub>2</sub>	O <sub>2</sub>	Steam
$(H - E_0)/RT_0$	$(H - E_0)$	cal mole <sup>-1</sup>	542.821	542.821	542.821	542.821	542.821	542.821	542.821
		cal g <sup>-1</sup>	18.7389	13.5896	12.3340	269.256	19.3754	16.9632	30.1299
$C_p/R, S/R$	$C_p, S$	joules g <sup>-1</sup>	78.4079	56.8589	51.6156	1126.57	81.0669	70.9742	126.064
		Btu (lb mole) <sup>-1</sup>	976.437	976.437	976.427	976.437	976.437	976.437	976.437
$\rho/\rho_0$ and for steam of $\rho$ in g cm <sup>-3</sup>	$\rho$	Btu lb <sup>-1</sup>	33.7098	24.4451	22.1667	484.344	34.8528	30.5157	54.1893
		cal mole <sup>-1</sup> °K <sup>-1</sup> (or °C <sup>-1</sup> )	1.98719	1.98719	1.98719	1.98719	1.98719	1.98719	1.98719
$\rho/\rho_0$ and for steam of $\rho$ in g cm <sup>-3</sup>	$\rho$	cal g <sup>-1</sup> °K <sup>-1</sup> (or °C <sup>-1</sup> )	0.0686942	0.0497494	0.051531	0.965709	0.0709305	0.0650997	0.110301
		joules g <sup>-1</sup> °K <sup>-1</sup> (or °C <sup>-1</sup> )	0.287011	0.208152	0.188921	4.12422	0.206774	0.256826	0.461500
Molecular weight	.....	Btu (lb mole) <sup>-1</sup> °R <sup>-1</sup> (or °F <sup>-1</sup> )	1.98583	1.98588	1.98588	1.98588	1.98588	1.98588	1.98588
		Btu lb <sup>-1</sup> °R <sup>-1</sup> (or °F <sup>-1</sup> )	0.0685890	0.0497166	0.051234	0.955069	0.0708838	0.0650588	0.110229
Molecular weight	.....	g cm <sup>-3</sup>	1.29301 × 10 <sup>-3</sup>	1.78377 × 10 <sup>-3</sup>	1.9770 × 10 <sup>-3</sup>	8.98854 × 10 <sup>-5</sup>	1.25046 × 10 <sup>-3</sup>	1.42900 × 10 <sup>-3</sup>	1
		mole cm <sup>-3</sup>	4.46409 × 10 <sup>-5</sup>	4.46568 × 10 <sup>-5</sup>	4.4822 × 10 <sup>-5</sup>	4.45860 × 10 <sup>-6</sup>	4.46338 × 10 <sup>-5</sup>	4.46562 × 10 <sup>-5</sup>	0.055506
Molecular weight	.....	g liter <sup>-1</sup>	1.29308	1.78382	1.9771	8.98879 × 10 <sup>-2</sup>	1.25050	1.42904	1.00003 × 10 <sup>3</sup>
		lb in <sup>-3</sup>	4.67143 × 10 <sup>-6</sup>	3.44432 × 10 <sup>-5</sup>	7.1424 × 10 <sup>-5</sup>	3.24734 × 10 <sup>-6</sup>	4.51760 × 10 <sup>-5</sup>	5.16282 × 10 <sup>-5</sup>	3.61275 × 10 <sup>-3</sup>
Molecular weight	.....	lb ft <sup>-3</sup>	8.07223 × 10 <sup>-2</sup>	9.111358	0.12342	5.61140 × 10 <sup>-3</sup>	7.80641 × 10 <sup>-2</sup>	8.92101 × 10 <sup>-2</sup>	62.4283
			28.466	39.944	44.010	2.016	28.016	32.000	18.016

Multiply by

TABLE 4h-3. COMPRESSIBILITY FACTOR FOR AIR,  $Z = \frac{PV}{RT}$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	0.98990						
200	0.99767	0.99067	0.98367	0.97666	0.9080	0.8481	0.8105
300	0.99970	0.99879	0.99797	0.99717	0.99135	0.9900	0.9833
400	1.00019	1.00079	1.00141	1.00205	1.00946	1.0188	1.0299
500	1.00034	1.00137	1.00242	1.00348	1.01454	1.0265	1.0393
600	1.00038	1.00152	1.00267	1.00385	1.01574	1.0281	1.0408
700	1.00038	1.00153	1.00268	1.00385	1.01558	1.0275	1.0397
800	1.00037	1.00148	1.00259	1.00371	1.01493	1.0263	1.0379
900	1.00035	1.00140	1.00246	1.00351	1.01411	1.0248	1.0356
1000	1.00033	1.00132	1.00231	1.00331	1.01325	1.0233	1.0333
1100	1.00031	1.00124	1.00218	1.00311	1.01245	1.0218	1.0312
1200	1.00029	1.00117	1.00205	1.00293	1.01170	1.0205	1.0292
1300	1.00028	1.00110	1.00193	1.00275	1.01100	1.0192	1.0275
1400	1.00026	1.00104	1.00182	1.00259	1.01037	1.0181	1.0259
1500	1.00024	1.00098	1.00171	1.00245	1.00978	1.0171	1.0244
1600	1.00023	1.00094	1.00163	1.00233	1.0093	1.0162	1.0232
1700	1.00023	1.00090	1.00157	1.00223	1.0088	1.0154	1.0220
1800	1.00024	1.00087	1.00152	1.00213	1.0083	1.0146	1.0208
1900	1.00027	1.00085	1.00146	1.00204	1.0079	1.0138	1.0198
2000	1.00035	1.00085	1.00140	1.00196	1.0076	1.0132	1.0188
2100	1.0006	1.0010	1.0014	1.0019	1.0073	1.0126	1.0180
2200	1.0008	1.0010	1.0014	1.0019	1.0070	1.0121	1.0172
2300	1.0014	1.0013	1.0016	1.0020	1.0067	1.0116	1.0165
2400	1.0023	1.0017	1.0019	1.0022	1.0067	1.0113	1.0160
2500	1.0036	1.0024	1.0024	1.0026	1.0066	1.0110	1.0155
2600	1.0056	1.0034	1.0031	1.0032	1.0067	1.0108	1.0151
2700	1.0086	1.0048	1.0042	1.0041	1.0068	1.0107	1.0148
2800	1.0124	1.0068	1.0057	1.0053	1.0071	1.0108	1.0145
2900	1.0178	1.0096	1.0079	1.0071	1.0079	1.0111	1.0147
3000	1.0252	1.0133	1.0107	1.0095	1.0092	1.0119	1.0151

TABLE 4h-4. RELATIVE DENSITY OF AIR,  $\rho/\rho_0$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	2.7830						
200	1.3681	5.511	9.713	13.976	60.13	112.66	168.40
300	0.9102	3.644	6.383	9.125	36.72	64.34	91.61
400	0.6823	2.727	4.771	6.811	27.043	46.89	66.27
500	0.5458	2.1809	3.813	5.441	21.526	37.23	52.53
600	0.4548	1.8171	3.176	4.532	17.917	30.977	43.71
700	0.3898	1.5575	2.726	3.885	15.360	26.567	37.51
800	0.3411	1.3629	2.3825	3.400	13.449	23.274	32.879
900	0.3032	1.2115	2.1180	3.023	11.964	20.720	29.290
1000	0.2729	1.0905	1.9065	2.721	10.777	18.675	26.419
1100	0.24809	0.9914	1.7334	2.474	9.805	17.001	24.066
1200	0.22742	0.9089	1.5892	2.268	8.994	15.605	22.103
1300	0.20993	0.8390	1.4671	2.094	8.308	14.422	20.438
1400	0.19494	0.7791	1.3625	1.945	7.720	13.406	19.007
1500	0.18195	0.7272	1.2718	1.815	7.209	12.525	17.766
1600	0.17058	0.6818	1.1924	1.702	6.762	11.753	16.675
1700	0.16054	0.6417	1.1223	1.602	6.367	11.070	15.712
1800	0.15162	0.6061	1.0600	1.513	6.016	10.463	14.857
1900	0.14364	0.5742	1.0043	1.434	5.702	9.921	14.089
2000	0.13645	0.5455	0.9541	1.362	5.419	9.430	13.398
2100	0.12992	0.5194	0.9087	1.297	5.162	8.986	12.770
2200	0.12399	0.4958	0.8674	1.239	4.929	8.582	12.199
2300	0.11852	0.4741	0.8295	1.185	4.716	8.213	11.676
2400	0.11348	0.4542	0.7947	1.135	4.520	7.873	11.195
2500	0.10880	0.4357	0.7625	1.089	4.339	7.560	10.753
2600	0.10441	0.4185	0.7327	1.047	4.172	7.271	10.343
2700	0.10024	0.4024	0.7048	1.007	4.017	7.003	9.963
2800	0.09630	0.3873	0.6786	0.970	3.872	6.752	9.610
2900	0.09249	0.3729	0.6538	0.935	3.736	6.517	9.277
3000	0.08876	0.3592	0.6302	0.901	3.607	6.295	8.964

TABLE 4h-5. SPECIFIC HEAT OF AIR,  $C_p/R$ 

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	3.5824	3.5495	3.5950	3.6427	4.256	5.132	6.079
200	3.5062	3.5220	3.5383	3.5546	3.722	3.889	4.046
300	3.5059	3.5416	3.5500	3.5583	3.640	3.717	3.788
400	3.5333	3.5932	3.5983	3.6032	3.652	3.697	3.739
500	3.5882	3.6660	3.6693	3.6726	3.705	3.735	3.763
600	3.6626	3.7479	3.7502	3.7525	3.775	3.797	3.817
700	3.7455	3.830	3.832	3.834	3.851	3.867	3.882
800	3.828	3.908	3.909	3.910	3.924	3.936	3.947
900	3.906	3.979	3.982	3.983	3.993	4.003	4.012
1000	3.979	4.046	4.048	4.049	4.057	4.065	4.072
1100	4.046	4.109	4.111	4.111	4.118	4.125	4.130
1200	4.109	4.172	4.172	4.173	4.179	4.184	4.189
1300	4.171	4.231	4.231	4.232	4.236	4.241	4.245
1400	4.230	4.289	4.290	4.290	4.294	4.298	4.302
1500	4.289	4.352	4.351	4.351	4.354	4.357	4.361
1600	4.352	4.414	4.413	4.414	4.416	4.419	4.421
1700	4.418	4.480	4.479	4.478	4.477	4.479	4.481
1800	4.487	4.549	4.544	4.543	4.540	4.540	4.542
1900	4.566	4.626	4.617	4.613	4.603	4.604	4.605
2000	4.662	4.715	4.699	4.692	4.674	4.670	4.671
2100	4.781	4.823	4.791	4.780	4.745	4.738	4.734
2200	4.947	4.969	4.918	4.893	4.828	4.814	4.806
2300	5.179	5.149	5.067	5.026	4.922	4.897	4.886
2400	5.484	5.373	5.247	5.186	5.028	4.987	4.971
2500	5.882	5.611	5.474	5.389	5.152	5.088	5.062
2600	6.40	6.019	5.753	5.634	5.295	5.203	5.172
2700	7.06	6.455	6.088	5.930	5.467	5.341	5.297
2800	7.87	6.993	6.497	6.300	5.668	5.496	5.434
2900	8.86	7.505	6.991	6.724	5.906	5.678	5.602
3000	9.96						

TABLE 4h-6. ENTHALPY OF AIR,  $(H - E_0^0)/RT_0$ 

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	1.2552	2.5281	2.5094	2.4908	2.2922	2.0794	1.8734
200	2.5465	3.8204	3.8118	3.8034	3.7194	3.6411	3.5699
300	3.8232	5.1167	5.1079	5.1039	5.0623	5.0252	4.9926
400	5.1167	6.4176	6.4154	6.4137	6.3951	6.3795	6.3670
500	6.4195	7.7463	7.7454	7.7449	7.7408	7.7388	7.7390
600	7.7463	9.1023	9.1035	9.1037	9.1096	9.1168	9.1253
700	9.1023	10.489	10.491	10.492	10.505	10.519	10.534
800	10.489	11.904	11.906	11.909	11.928	11.947	11.968
900	11.904	13.348	13.352	13.354	13.377	13.400	13.424
1000	13.348	14.817	14.822	14.824	14.851	14.877	14.904
1100	14.817	16.312	16.316	16.318	16.347	16.376	16.405
1200	16.312	17.826	17.828	17.834	17.866	17.897	17.928
1300	17.826	19.363	19.370	19.373	19.407	19.440	19.471
1400	19.363	20.924	20.929	20.932	20.968	21.003	21.036
1500	20.924	22.504	22.511	22.514	22.551	22.587	22.621
1600	22.504	24.110	24.116	24.118	24.156	24.193	24.228
1700	24.110	25.740	25.744	25.746	25.784	25.821	25.857
1800	25.740	27.392	27.394	27.396	27.434	27.472	27.509
1900	27.392	29.071	29.070	29.072	29.108	29.146	29.183
2000	29.071	30.781	30.774	30.775	30.806	30.844	30.881
2100	30.781	32.527	32.510	32.509	32.530	32.566	32.603
2200	32.527	34.318	34.286	34.279	34.282	34.315	34.349
2300	34.318	36.169	36.137	36.123	36.167	36.192	36.223
2400	36.169	38.093	38.063	38.061	38.092	38.115	38.143
2500	38.093	40.110	40.085	40.086	40.110	40.134	40.158
2600	40.110	42.246	42.226	42.226	42.246	42.266	42.286
2700	42.246	44.528	44.513	44.513	44.528	44.546	44.564
2800	44.528	46.985	46.974	46.974	46.985	47.000	47.015
2900	46.985	49.655	49.655	49.655	49.666	49.681	49.696
3000	49.655	52.403	52.403	52.403	52.414	52.429	52.444

TABLE 4h-8. COMPRESSIBILITY FACTOR FOR ARGON,  $Z = PV/RT$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	0.9782	0.98818	0.97923	0.97023	0.8778	0.7838	0.6917
200	0.99706	0.99750	0.99565	0.99382	0.9773	0.9043	0.8553
300	0.99937	0.99991	0.99986	0.99982	1.0002	1.0022	1.0057
400	1.00018	1.00072	1.00127	1.00183	1.0079	1.0147	1.0224
500	1.00018	1.00072	1.00127	1.00183	1.0079	1.0147	1.0224
600	1.00025	1.00101	1.00178	1.00255	1.0105	1.0190	1.0279
700	1.00027	1.00111	1.00194	1.00278	1.0113	1.0201	1.0292
800	1.00028	1.00111	1.00195	1.00279	1.0113	1.0201	1.0288
900	1.00027	1.00109	1.00191	1.00273	1.0110	1.0194	1.0279
1000	1.00026	1.00104	1.00183	1.00261	1.0105	1.0185	1.0265
1100	1.00025	1.00100	1.00174	1.00249	1.0100	1.0176	1.0252
1200	1.00024	1.00095	1.00166	1.00237	1.0095	1.0167	1.0239
1300	1.00023	1.00090	1.00158	1.00225	1.0090	1.0158	1.0226
1400	1.00021	1.00085	1.00149	1.00213	1.0085	1.0149	1.0213
1500	1.00020	1.00081	1.00142	1.00203	1.0081	1.0142	1.0203
1600	1.00019	1.00077	1.00135	1.00193	1.0077	1.0135	1.0193
1700	1.00018	1.00073	1.00128	1.00183	1.0073	1.0128	1.0183
1800	1.00018	1.00070	1.00123	1.00175	1.0070	1.0123	1.0175
1900	1.00017	1.00067	1.00117	1.00167	1.0067	1.0117	1.0167
2000	1.00016	1.00064	1.00111	1.00159	1.0064	1.0111	1.0159
2100	1.00015	1.00061	1.00107	1.00153	1.0061	1.0107	1.0153
2200	1.00015	1.00058	1.00102	1.00146	1.0058	1.0102	1.0146
2300	1.00014	1.00056	1.00098	1.00140	1.0056	1.0098	1.0140
2400	1.00014	1.00054	1.00095	1.00135	1.0054	1.0095	1.0135
2500	1.00013	1.00052	1.00091	1.00130	1.0052	1.0091	1.0130
2600	1.00013	1.00050	1.00088	1.00125	1.0050	1.0088	1.0125
2700	1.00012	1.00048	1.00084	1.00120	1.0048	1.0084	1.0120
2800	1.00012	1.00046	1.00081	1.00116	1.0046	1.0081	1.0116
2900	1.00011	1.00045	1.00078	1.00112	1.0045	1.0078	1.0112
3000	1.00011	1.00043	1.00076	1.00108	1.0043	1.0076	1.0108

TABLE 4h-7. ENTROPY OF AIR,  $S/R$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	20.049	21.091	20.513	20.139	18.551	17.767	17.184
200	22.497	22.524	21.958	21.594	20.138	19.513	19.095
300	23.917	23.539	22.976	22.616	21.194	20.602	20.214
400	24.929	24.335	23.773	23.414	22.006	21.428	21.056
500	25.723	24.935	24.434	24.077	22.677	22.104	21.736
600	26.383	25.567	25.006	24.649	23.253	22.685	22.320
700	26.954	26.073	25.512	25.155	23.762	23.196	22.833
800	27.460	26.528	25.968	25.610	24.219	23.655	23.293
900	27.915	26.944	26.384	26.025	24.634	24.071	23.709
1000	28.330	27.327	26.767	26.408	25.018	24.454	24.093
1100	28.713	27.682	27.122	26.763	25.373	24.809	24.448
1200	29.068	28.013	27.453	27.093	25.702	25.138	24.777
1300	29.399	28.324	27.764	27.404	26.013	25.448	25.087
1400	29.711	28.618	28.058	27.698	26.306	25.741	25.380
1500	30.005	28.897	28.337	27.977	26.585	26.020	25.659
1600	30.284	29.162	28.602	28.242	26.850	26.287	25.926
1700	30.549	29.416	28.856	28.496	27.104	26.542	26.181
1800	30.804	29.660	29.100	28.740	27.346	26.785	26.424
1900	31.048	29.896	29.335	28.974	27.582	27.019	26.658
2000	31.284	30.124	29.563	29.201	27.808	27.245	26.884
2100	31.514	30.346	29.784	29.421	28.027	27.463	27.102
2200	31.740	30.563	29.999	29.636	28.240	27.676	27.314
2300	31.964	30.778	30.212	29.847	28.447	27.883	27.520
2400	32.191	30.992	30.422	30.055	28.650	28.084	27.721
2500	32.423	31.208	30.632	30.263	28.849	28.281	27.918
2600	32.663	31.428	30.844	30.471	29.046	28.476	28.111
2700	32.917	31.654	31.059	30.681	29.242	28.669	28.302
2800	33.188	31.889	31.279	30.895	29.438	28.861	28.491
2900	33.481	32.136	31.507	31.114	29.634	29.052	28.678
3000	33.799						

TABLE 4h-9. RELATIVE DENSITY OF ARGON,  $\rho/\rho_0$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	2.79	5.5232	9.754	14.064	62.18	121.9	197.3
200	1.3085	3.6477	6.3954	9.1531	37.23	66.03	95.22
300	0.91023	2.7292	4.7764	6.8237	27.28	47.65	67.84
400	0.68226	2.1816	3.8157	5.4480	21.66	37.65	53.38
500	0.54570	1.8175	3.1781	4.5367	18.00	31.25	44.25
600	0.45471	1.5577	2.7237	3.8877	15.42	26.75	37.88
700	0.38975	1.3630	2.3832	3.4017	13.49	23.41	33.16
800	0.34103	1.2116	2.1185	3.0239	12.00	20.82	29.50
900	0.30314	1.0905	1.9068	2.7219	10.80	18.76	26.59
1000	0.27283	0.99136	1.7336	2.4747	9.825	17.07	24.20
1100	0.24803	0.90879	1.5893	2.2688	9.011	15.66	22.21
1200	0.22736	0.83893	1.4671	2.0945	8.322	14.47	20.53
1300	0.20987	0.77904	1.3625	1.9451	7.731	13.44	19.09
1400	0.19489	0.72714	1.2717	1.8156	7.219	12.56	17.83
1500	0.18189	0.68172	1.1923	1.7023	6.770	11.78	16.73
1600	0.17053	0.64164	1.1223	1.6023	6.375	11.09	15.76
1700	0.16050	0.60601	1.0600	1.5134	6.022	10.48	14.90
1800	0.15158	0.57414	1.0042	1.4339	5.707	9.938	14.13
1900	0.14361	0.54544	0.95408	1.3623	5.423	9.447	13.43
2000	0.13643	0.51940	0.90868	1.2975	5.167	9.000	12.80
2100	0.12993	0.49589	0.86742	1.2386	4.933	8.595	12.23
2200	0.12403	0.47434	0.82974	1.1848	4.720	8.225	11.70
2300	0.11863	0.45458	0.79520	1.1355	4.524	7.885	11.22
2400	0.11369	0.43641	0.76342	1.0902	4.344	7.572	10.78
2500	0.10914	0.41963	0.73408	1.0483	4.178	7.283	10.37
2600	0.10495	0.40410	0.70692	1.0095	4.024	7.016	9.987
2700	0.10106	0.38967	0.68169	0.9735	3.881	6.768	9.635
2800	0.097452	0.37624	0.65820	0.93997	3.747	6.536	9.306
2900	0.094092	0.36371	0.63628	0.90868	3.623	6.320	8.999
3000	0.090956						

TABLE 4h-10. SPECIFIC HEAT OF ARGON,  $C_p/R$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	2.6177	2.626	2.612	2.663	3.31	4.2	5.2
200	2.5154	2.5057	2.504	2.5581	2.74	2.93	3.12
300	2.5029	2.5118	2.5206	2.5294	2.61	2.70	2.79
400	2.5018	2.5071	2.5124	2.5176	2.570	2.621	2.670
500							
600	2.5012	2.5047	2.5082	2.5117	2.546	2.579	2.611
700	2.5008	2.5033	2.5058	2.5082	2.532	2.555	2.578
800	2.5006	2.5025	2.5043	2.5062	2.524	2.541	2.558
900	2.5005	2.5020	2.5033	2.5047	2.519	2.531	2.544
1000	2.5004	2.5015	2.5026	2.5037	2.515	2.525	2.536
1100	2.5003	2.5012	2.5021	2.5030	2.512	2.520	2.528
1200	2.5002	2.5010	2.5017	2.5024	2.510	2.516	2.523
1300	2.5002	2.5008	2.5014	2.5020	2.508	2.514	2.519
1400	2.5001	2.5007	2.5012	2.5017	2.507	2.512	2.516
1500	2.5001	2.5006	2.5010	2.5014	2.506	2.510	2.513
1600	2.5001	2.5005	2.5009	2.5012	2.505	2.509	2.511
1700	2.5001	2.5004	2.5007	2.5011	2.504	2.507	2.511
1800	2.5001	2.5004	2.5006	2.5009	2.504	2.506	2.509
1900	2.5001	2.5003	2.5006	2.5008	2.503	2.506	2.508
2000	2.5001	2.5003	2.5005	2.5007	2.503	2.505	2.507
2100							
2200	2.5001	2.5002	2.5004	2.5006	2.502	2.504	2.506
2300	2.5001	2.5002	2.5004	2.5005	2.502	2.504	2.505
2400	2.5001	2.5002	2.5003	2.5004	2.502	2.503	2.504
2500	2.5000	2.5002	2.5003	2.5004	2.502	2.503	2.504
2600	2.5000	2.5001	2.5002	2.5003	2.501	2.502	2.503
2700	2.5000	2.5001	2.5002	2.5003	2.501	2.502	2.503
2800	2.5000	2.5001	2.5002	2.5003	2.501	2.502	2.503
2900	2.5000	2.5001	2.5002	2.5003	2.501	2.502	2.503
3000	2.5000	2.5001	2.5002	2.5003	2.501	2.502	2.503

TABLE 4h-11. ENTHALPY OF ARGON,  $(H - E_0^0)/RT_0$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	0.8935						
200	1.8236	1.8029	1.7819	1.7606	1.53	1.3	2.42
300	2.7422	2.7319	2.7217	2.7114	2.610	2.512	3.48
400	3.6590	3.6532	3.6476	3.6418	3.586	3.533	4.48
500	4.5750	4.5718	4.5686	4.5654	4.535	4.506	5.445
600	5.4907	5.4891	5.4874	5.4859	5.471	5.457	6.395
700	6.4063	6.4057	6.4052	6.4047	6.400	6.397	7.335
800	7.3218	7.3220	7.3222	7.3226	7.326	7.330	8.268
900	8.2372	8.2380	8.2388	8.2396	8.249	8.258	9.198
1000	9.1525	9.1538	9.1551	9.1564	9.170	9.184	10.125
1100	10.0679	10.0696	10.0712	10.0729	10.090	10.107	11.049
1200	10.9832	10.9852	10.9871	10.9891	11.009	11.029	11.972
1300	11.8985	11.9007	11.9029	11.9051	11.927	11.950	12.894
1400	12.8138	12.8162	12.8186	12.8210	12.845	12.869	13.815
1500	13.7291	13.7316	13.7342	13.7367	13.763	13.788	14.735
1600	14.6443	14.6470	14.6497	14.6524	14.680	14.707	15.654
1700	15.5595	15.5624	15.5652	15.5680	15.597	15.625	16.572
1800	16.4749	16.4778	16.4808	16.4837	16.513	16.543	17.491
1900	17.3901	17.3931	17.3962	17.3992	17.430	17.460	18.409
2000	18.3053	18.3085	18.3116	18.3147	18.346	18.377	19.326
2100	19.2206	19.2238	19.2269	19.2301	19.262	19.294	20.243
2200	20.1358	20.1390	20.1423	20.1456	20.178	20.211	21.160
2300	21.0510	21.0543	21.0576	21.0609	21.094	21.127	22.077
2400	21.9662	21.9696	21.9729	21.9763	22.010	22.044	22.994
2500	22.8815	22.8849	22.8884	22.8918	22.926	22.960	23.911
2600	23.7967	23.8002	23.8036	23.8071	23.842	23.876	24.827
2700	24.7120	24.7154	24.7189	24.7224	24.757	24.792	25.743
2800	25.6272	25.6307	25.6342	25.6377	25.673	25.708	26.659
2900	26.5424	26.5459	26.5495	26.5530	26.589	26.624	27.575
3000	27.4576	27.4612	27.4647	27.4683	27.504	27.540	

TABLE 4h-12. ENTROPY OF ARGON, S/R

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	15.8425						
200	17.6069	16.2012	15.6218	15.245	13.64	12.83	12.2
300	18.6245	17.2308	16.6637	16.2995	14.8389	14.2067	13.781
400	19.3449	17.9548	17.3913	17.0808	15.6067	15.0118	14.618
500	19.9032	18.5146	17.9527	17.5937	16.1850	15.6037	15.2261
600	20.3593	18.9715	18.4104	18.0522	16.6513	16.0776	15.7072
700	20.7449	19.3575	18.7969	18.4391	17.0426	16.4732	16.1070
800	21.0787	19.6917	19.1313	18.7739	17.3802	16.8134	16.4498
900	21.3733	19.9864	19.4263	19.0690	17.6772	17.1122	16.7503
1000	21.6368	20.2500	19.6900	19.3328	17.9423	17.3785	17.0179
1100	21.8751	20.4884	19.9285	19.5715	18.1819	17.6190	17.2592
1200	22.0926	20.7060	20.1462	19.7892	18.4003	17.8381	17.4789
1300	22.2927	20.9062	20.3464	19.9895	18.6010	18.0394	17.6807
1400	22.4780	21.0916	20.5318	20.1749	18.7869	18.2256	17.8673
1500	22.6505	21.2640	20.7043	20.3474	18.9597	18.3988	18.0408
1600	22.8119	21.4254	20.8657	20.5089	19.1214	18.5607	18.2029
1700	22.9635	21.5771	21.0174	20.6606	19.2733	18.7128	18.3552
1800	23.1064	21.7200	21.1603	20.8035	19.4165	18.8561	18.4987
1900	23.2415	21.8551	21.2955	20.9387	19.5518	18.9915	18.6343
2000	23.3698	21.9834	21.4238	21.0670	19.6802	19.1201	18.7630
2100	23.4917	22.1053	21.5457	21.1890	19.8022	19.2422	18.8851
2200	23.6080	22.2217	21.6620	21.3053	19.9187	19.3587	19.0017
2300	23.7192	22.3329	21.7732	21.4165	20.0299	19.4701	19.1131
2400	23.8256	22.4393	21.8797	21.5229	20.1364	19.5766	19.2197
2500	23.9276	22.5413	21.9817	21.6249	20.2385	19.6787	19.3218
2600	24.0257	22.6394	22.0798	21.7231	20.3366	19.7769	19.4201
2700	24.1200	22.7337	22.1741	21.8174	20.4310	19.8713	19.5145
2800	24.2109	22.8246	22.2650	21.9083	20.5219	19.9623	19.6055
2900	24.2987	22.9124	22.3528	21.9961	20.6098	20.0501	19.6934
3000	24.3834	22.9971	22.4375	22.0808	20.6945	20.1349	19.7782



TABLE 4h-13. COMPRESSIBILITY FACTOR FOR HYDROGEN,  
 $Z = PV/RT$ TABLE 4h-14. RELATIVE DENSITY OF HYDROGEN,  $\rho/\rho_0$ 

T, K	Z = PV/RT						Relative Density of Hydrogen, $\rho/\rho_0$							
	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
40	0.9845	0.9362	0.8853	0.8317	0.8757	0.8700	0.9395	6.9408	29.195	54.029	82.160	208.08	366.53	484.88
60	0.9955	0.9822	0.9691	0.9564	0.9682	0.9782	1.0174	4.5701	18.552	32.905	47.632	141.15	244.49	335.82
80	0.9986	0.9946	0.9908	0.9872	0.9982	1.0222	1.0560	3.4314	13.740	24.138	34.609	109.01	187.17	258.83
100	0.9998	0.9992	0.9987	0.9983	1.0029	1.0222	1.0560	2.7338	10.942	19.158	27.379	109.01	187.17	258.83
120	1.0003	1.0012	1.0021	1.0030	1.0176	1.0405	1.0726	2.2771	9.0999	15.910	22.709	89.532	153.23	212.36
140	1.0005	1.0020	1.0036	1.0052	1.0243	1.0488	1.0786	1.9314	7.7937	13.617	19.422	76.240	130.30	181.01
160	1.0006	1.0024	1.0043	1.0062	1.0271	1.0516	1.0798	1.7773	6.8167	11.907	16.978	66.528	113.71	158.21
180	1.0007	1.0028	1.0048	1.0067	1.0283	1.0523	1.0785	1.5774	6.0569	10.578	15.084	59.067	101.01	140.80
200	1.0007	1.0028	1.0048	1.0068	1.0283	1.0513	1.0760	1.3557	5.4512	9.5206	13.574	53.160	90.995	127.01
220	1.0007	1.0028	1.0048	1.0067	1.0276	1.0497	1.0730	1.2415	4.9557	8.6551	12.341	48.361	82.849	115.79
240	1.0007	1.0027	1.0047	1.0056	1.0269	1.0480	1.0698	1.1381	4.5431	7.9347	11.314	44.361	76.068	106.46
260	1.0006	1.0024	1.0044	1.0064	1.0259	1.0459	1.0667	1.0506	4.1949	7.3265	10.446	40.988	70.358	98.553
280	1.0006	1.0024	1.0042	1.0061	1.0247	1.0439	1.0636	0.97559	3.8953	6.8045	9.7026	38.105	65.457	91.780
300	1.0006	1.0024	1.0042	1.0059	1.0238	1.0420	1.0607	0.91055	3.5356	6.3509	9.0575	35.596	61.204	85.896
320	1.0006	1.0024	1.0041	1.0057	1.0229	1.0402	1.0579	0.85364	3.4084	5.9546	8.4931	33.401	57.479	80.740
340	1.0005	1.0021	1.0037	1.0054	1.0217	1.0384	1.0553	0.80351	3.2088	5.6065	7.9959	31.473	54.192	76.178
360	1.0005	1.0020	1.0036	1.0052	1.0209	1.0367	1.0529	0.75887	3.0309	5.2956	7.5532	29.748	51.265	72.110
380	1.0005	1.0020	1.0035	1.0050	1.0201	1.0353	1.0507	0.71893	2.8714	5.0174	7.1571	28.204	48.632	68.458
400	1.0005	1.0020	1.0034	1.0048	1.0193	1.0339	1.0486	0.68298	2.7278	4.7670	6.8006	26.815	46.286	65.165
420	1.0005	1.0019	1.0033	1.0046	1.0185	1.0325	1.0466	0.65046	2.5982	4.5404	6.4780	25.558	44.120	62.181
440	1.0004	1.0017	1.0030	1.0045	1.0180	1.0314	1.0448	0.62095	2.4806	4.3353	6.1842	24.408	42.160	59.457
460	1.0004	1.0016	1.0029	1.0043	1.0172	1.0301	1.0431	0.59396	2.3729	4.1473	5.9165	23.365	40.377	56.964
480	1.0004	1.0016	1.0028	1.0041	1.0165	1.0289	1.0415	0.56921	2.2741	3.9749	5.6711	22.407	38.740	54.675
500	1.0004	1.0016	1.0028	1.0040	1.0160	1.0280	1.0400	0.54644	2.1851	3.8159	5.4448	21.522	37.223	52.563
520	1.0004	1.0016	1.0028	1.0039	1.0155	1.0271	1.0385	0.52542	2.0991	3.6691	5.2359	20.704	35.823	50.615
540	1.0004	1.0016	1.0026	1.0037	1.0148	1.0260	1.0372	0.50596	2.0214	3.5339	5.0430	19.951	34.533	48.801
560	1.0004	1.0015	1.0026	1.0036	1.0144	1.0252	1.0360	0.48789	1.9494	3.4077	4.8634	19.246	33.326	47.113
580	1.0003	1.0013	1.0024	1.0035	1.0140	1.0244	1.0348	0.47112	1.8826	3.2908	4.6961	18.590	32.202	45.541
600	1.0003	1.0012	1.0023	1.0034	1.0136	1.0237	1.0337	0.45541	1.8200	3.1815	4.5400	17.977	31.150	44.070

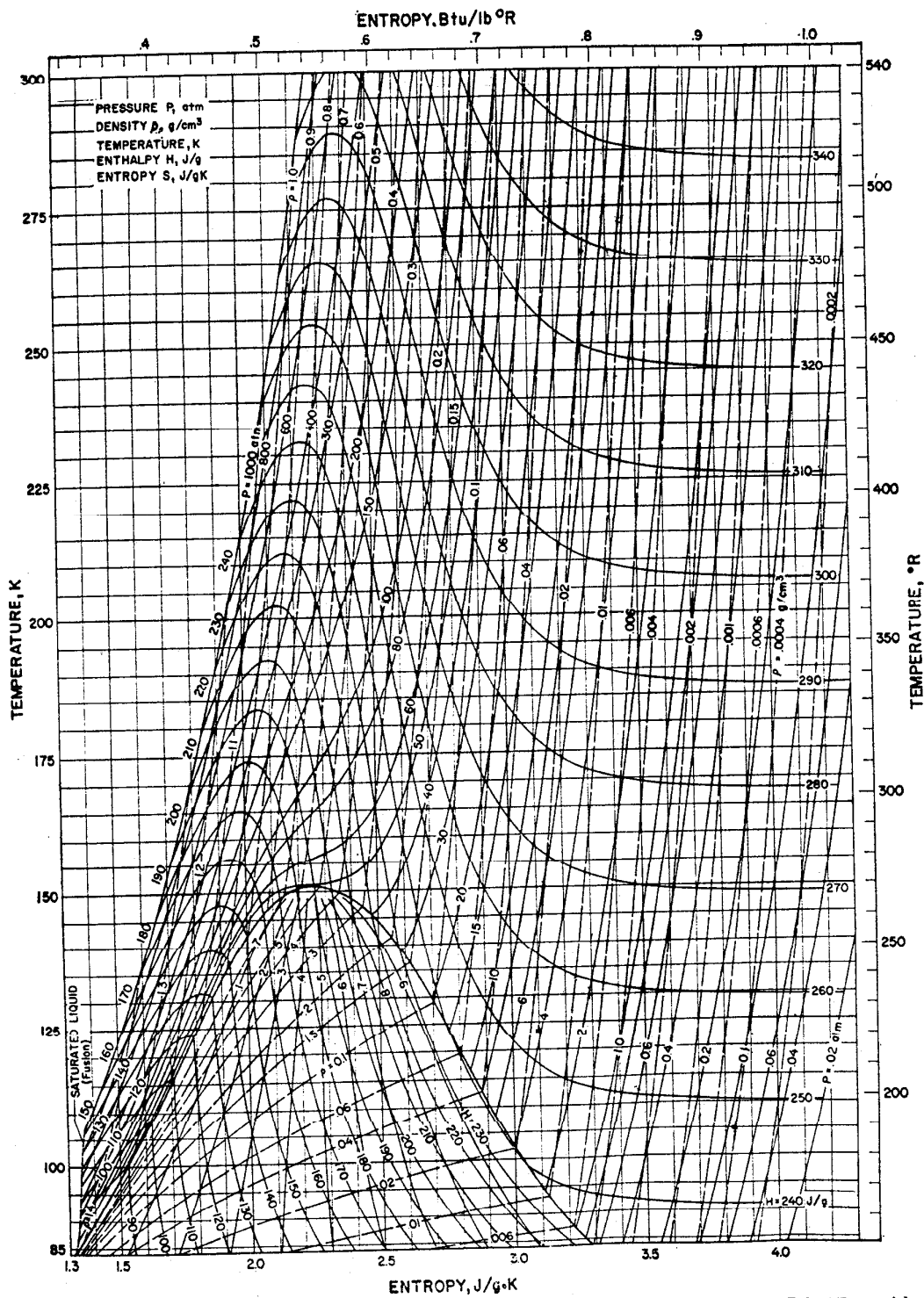


FIG. 4h-1. Temperature-entropy diagram for argon. (From NSRDS-NBS 27 entitled *Thermodynamic Properties of Argon from the Triple Point to 300 K at Pressures to 1,000 Atmospheres*, authored by A. L. Gosman, R. D. McCarthy, and J. G. Hurt, U.S. Government Printing Office, Washington, D.C.)



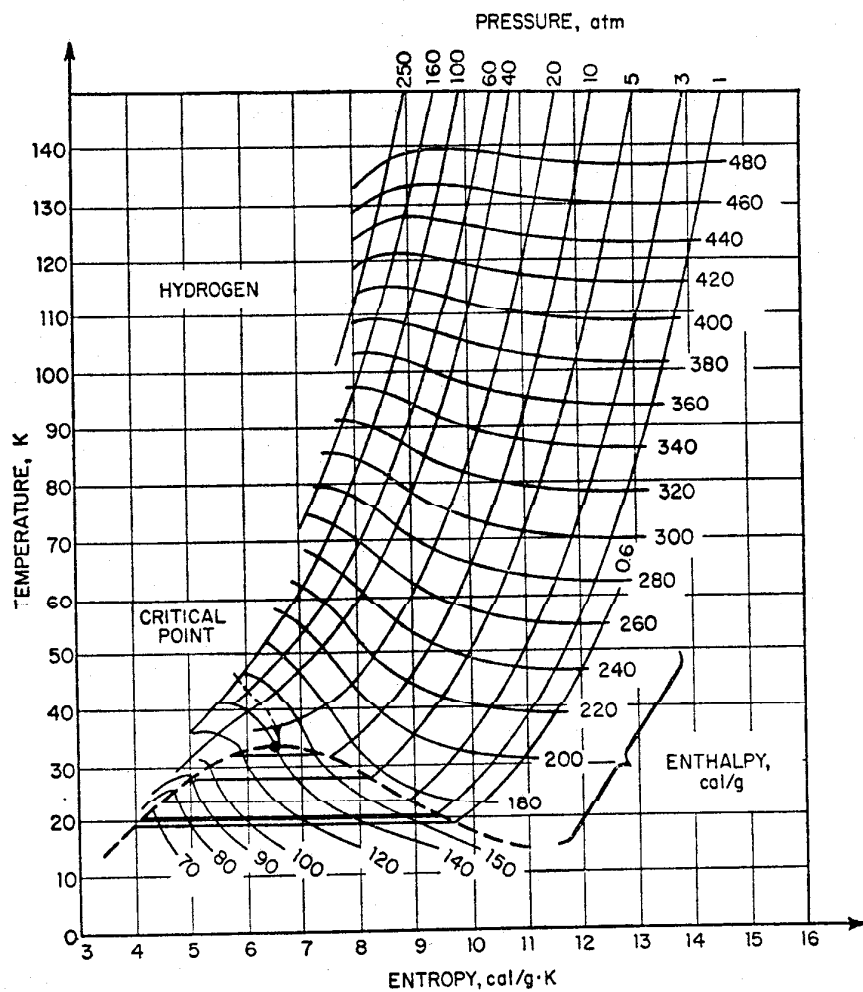


FIG. 4h-2. Temperature-entropy diagram for hydrogen. [H. W. Woolley, R. B. Scott, and F. G. Brickwedde, *NBS J. Research* 41 (1948).]

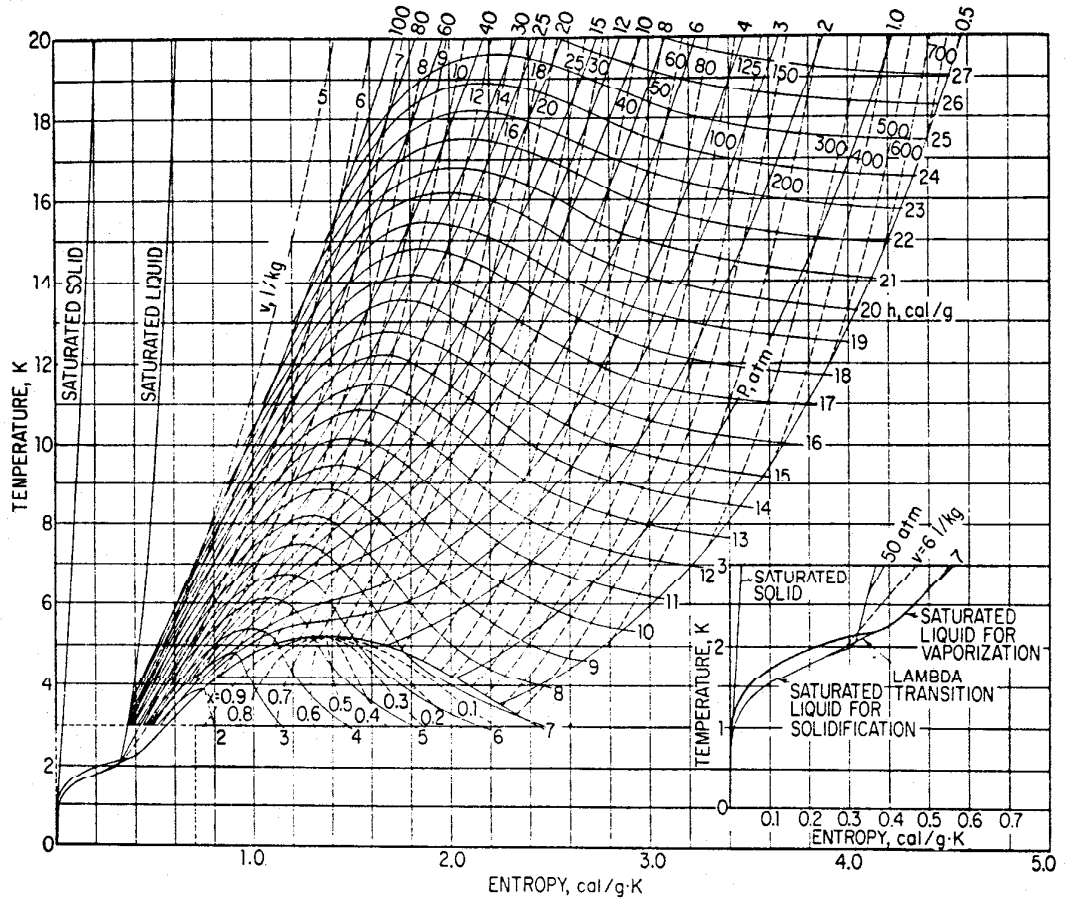


FIG. 4h-3. Temperature-entropy diagram of helium. (D. B. Mann and R. B. Stewart, National Bureau of Standards and University of Colorado, *Trans. ASME*, November, 1959.)

TABLE 4h-20. SPECIFIC HEAT OF NITROGEN,  $C_p/R$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	3.613						
200	3.5146	3.5569	3.5009	3.6466	4.1865	4.860	5.64
300	3.5083	3.5243	3.5404	3.5565	3.7195	3.878	4.021
400	3.5207	3.5289	3.5372	3.5454	3.6260	3.7023	3.773
500	3.5595	3.5645	3.5694	3.5744	3.6225	3.6680	3.7104
600	3.6225	3.6258	3.6292	3.6324	3.6642	3.6944	3.7229
700	3.6998	3.7021	3.7045	3.7067	3.7293	3.7506	3.7709
800	3.7812	3.7829	3.7846	3.7863	3.8029	3.8188	3.8338
900	3.8600	3.8614	3.8627	3.8640	3.8766	3.8888	3.9004
1000	3.9329	3.9340	3.9350	3.9361	3.9460	3.9556	3.9647
1100	3.9985	3.9993	4.0001	4.0010	4.0089	4.0166	4.0239
1200	4.0564	4.0571	4.0578	4.0584	4.0649	4.0712	4.0772
1300	4.1074	4.1079	4.1085	4.1091	4.1144	4.1197	4.1247
1400	4.1520	4.1524	4.1529	4.1533	4.1578	4.1621	4.1663
1500	4.1910	4.1914	4.1918	4.1922	4.1960	4.1995	4.2031
1600	4.2253	4.2256	4.2260	4.2263	4.2295	4.2325	4.2356
1700	4.2555	4.2558	4.2561	4.2563	4.2591	4.2618	4.2644
1800	4.2822	4.2824	4.2827	4.2829	4.2852	4.2875	4.2893
1900	4.3058	4.3060	4.3062	4.3064	4.3084	4.3103	4.3122
2000	4.3269	4.3270	4.3272	4.3274	4.3292	4.3309	4.3325
2100	4.3458	4.3459	4.3461	4.3462	4.3478	4.3492	4.3507
2200	4.3627	4.3629	4.3630	4.3632	4.3645	4.3658	4.3671
2300	4.3780	4.3782	4.3783	4.3784	4.3796	4.3807	4.3818
2400	4.3920	4.3922	4.3922	4.3924	4.3934	4.3944	4.3953
2500	4.4047	4.4048	4.4049	4.4050	4.4059	4.4068	4.4076
2600	4.4163	4.4164	4.4165	4.4166	4.4174	4.4182	4.4189
2700	4.4270	4.4271	4.4272	4.4272	4.4280	4.4287	4.4293
2800	4.4369	4.4370	4.4370	4.4371	4.4377	4.4384	4.4389
2900	4.4460	4.4461	4.4461	4.4462	4.4467	4.4473	4.4478
3000	4.4545	4.4546	4.4546	4.4547	4.4551	4.4556	4.4561

TABLE 4h-19. RELATIVE DENSITY OF NITROGEN,  $\rho/\rho_0$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	2.783	12.010	24.40	13.947	59.45	109.77	161.7
200	1.36809	5.50755	9.7004	6.3783	36.543	63.810	90.523
300	0.91029	3.64304	6.3783	5.8061	26.955	46.625	65.741
400	0.68240	2.72729	4.76856	5.4382	21.472	37.065	52.200
500	0.54585	2.18072	3.81150	4.5307	17.881	30.866	43.484
600	0.45486	1.81708	3.17571	3.8838	15.334	26.485	37.339
700	0.38989	1.55755	2.72218	3.3090	13.429	23.212	32.754
800	0.34116	1.36296	2.38226	3.0223	11.949	20.673	29.195
900	0.30326	1.21163	2.11792	2.7206	10.765	18.631	26.342
1000	0.27294	1.09058	1.90645	2.4737	9.796	16.971	24.003
1100	0.24813	0.99152	1.73342	2.2681	8.987	15.579	22.049
1200	0.22746	0.90898	1.58920	2.0940	8.302	14.401	20.393
1300	0.20997	0.83912	1.46715	1.9418	7.714	13.389	18.971
1400	0.19497	0.77923	1.36253	1.8155	7.205	12.510	17.734
1500	0.18198	0.72733	1.27183	1.7022	6.758	11.739	16.618
1600	0.17061	0.68191	1.19246	1.6023	6.364	11.060	15.690
1700	0.16057	0.64184	1.12242	1.5135	6.014	10.455	14.837
1800	0.15165	0.60621	1.06016	1.4340	5.699	9.912	14.072
1900	0.14367	0.57433	1.00411	1.3625	5.416	9.423	13.381
2000	0.13649	0.54563	0.95428	1.2977	5.161	8.980	12.755
2100	0.12989	0.51967	0.90890	1.2388	4.927	8.576	12.186
2200	0.12409	0.49606	0.86763	1.1850	4.715	8.208	11.665
2300	0.11869	0.47451	0.82996	1.1357	4.519	7.870	11.187
2400	0.11375	0.45475	0.79542	1.0904	4.340	7.559	10.747
2500	0.10920	0.43658	0.76361	1.0485	4.174	7.271	10.340
2600	0.10500	0.41980	0.73430	1.0097	4.020	7.005	9.963
2700	0.10111	0.40426	0.70713	0.9737	3.878	6.757	9.611
2800	0.09750	0.38983	0.68190	0.9402	3.745	6.527	9.286
2900	0.09414	0.37639	0.65842	0.9089	3.620	6.310	8.980
3000	0.09100	0.36385	0.63648				

TABLE 4h-22. ENTROPY OF NITROGEN,  $S/R$ 

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	19.1705	17.607	16.55	19.2682	17.6905	16.932	16.382
200	21.6249	20.2208	19.3431	20.7248	19.2706	18.6461	18.230
300	23.0482	21.6549	21.0884	21.7454	20.3246	19.7322	19.3448
400	24.0586	22.6087	22.1055	22.5390	21.1322	20.5532	20.1781
500	24.8479	23.4595	22.3977	23.1953	21.7958	21.2236	20.8548
600	25.5220	24.1144	23.5534	23.7607	22.3654	21.7970	21.4319
700	26.0362	24.6790	24.1184	24.2609	22.8682	22.3022	21.9396
800	26.5156	25.1786	24.6183	24.7113	23.3203	22.7561	22.3949
900	27.0154	25.6286	25.0685	25.1223	23.7323	23.1693	22.8094
1000	27.4260	26.0393	25.4793	25.5004	24.1114	23.5491	23.1899
1100	27.8039	26.4173	25.8574	25.8511	24.4627	23.9010	23.5424
1200	28.1543	26.7678	26.2080	26.1780	24.7901	24.2289	23.8707
1300	28.4811	27.0947	26.5349	26.4842	25.0965	24.5357	24.1779
1400	28.7872	27.4007	26.8410	26.7721	25.3848	24.8242	24.4666
1500	29.0751	27.6887	27.1290	27.0438	25.6567	25.0964	24.7390
1600	29.3467	27.9603	27.4006	27.3009	25.9140	25.3537	24.9965
1700	29.6037	28.2173	27.6577	27.5449	26.1582	25.5981	25.2410
1800	29.8477	28.4613	27.9017	27.7772	26.3905	25.8306	25.4736
1900	30.0799	28.6936	28.1339	27.9986	26.6120	26.0522	25.6953
2000	30.3013	28.9150	28.3553	28.2102	26.8238	26.2640	25.9072
2100	30.5129	29.1266	28.5670	28.4128	27.0264	26.4667	26.1100
2200	30.7154	29.3291	28.7695	28.6071	27.2207	26.6611	26.3043
2300	30.9097	29.5234	28.9638	28.7937	27.4074	26.8478	26.4911
2400	31.0963	29.7100	29.1504	28.9733	27.5870	27.0275	26.6708
2500	31.2759	29.8896	29.3300	29.1462	27.7600	27.2004	26.8438
2600	31.4488	30.0625	29.5029	29.3131	27.9269	27.3674	27.0108
2700	31.6157	30.2294	29.6698	29.4743	28.0882	27.5287	27.1721
2800	31.7769	30.3906	29.8310	29.6301	28.2440	27.6846	27.3280
2900	31.9327	30.5464	29.9868	29.7810	28.3949	27.8355	27.4790
3000	32.0836	30.6973	30.1377	29.9286	28.5400	27.9810	27.6250

TABLE 4h-21. ENTHALPY OF NITROGEN,  $(H - E_0^0)/RT^0$ 

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	1.2589	2.5358	2.5179	2.4999	2.3140	2.125	1.94
200	2.5335	3.8302	3.8221	3.8140	3.7351	3.662	3.596
300	3.8385	5.1203	5.1164	5.1125	5.0756	5.013	4.948
400	5.1244	6.4178	6.4162	6.4147	6.4005	6.3891	6.3802
500	6.4194	7.7333	7.7332	7.7331	7.7332	7.7354	7.7393
600	7.7334	9.0744	9.0752	9.0762	9.0861	9.0977	9.1103
700	9.0735	10.4428	10.4444	10.4460	10.4647	10.4829	10.5020
800	10.4416	11.8438	11.8459	11.8482	11.8705	11.8937	11.9177
900	11.8463	13.2708	13.2734	13.2760	13.3025	13.3296	13.3573
1000	13.2683	14.7232	14.7261	14.7290	14.7588	14.7891	14.8197
1100	14.7203	16.1950	16.1982	16.2014	16.2369	16.2697	16.3029
1200	16.1950	17.6929	17.6963	17.6997	17.7343	17.7691	17.8043
1300	17.6894	19.2050	19.2086	19.2122	19.2486	19.2851	19.3221
1400	19.2014	20.7325	20.7363	20.7400	20.7779	20.8159	20.8542
1500	20.7288	22.2734	22.2773	22.2812	22.3203	22.3597	22.3992
1600	22.2695	23.8259	23.8299	23.8340	23.8742	23.9146	23.9550
1700	23.8219	25.3889	25.3930	25.3971	25.4382	25.4795	25.5209
1800	25.3848	26.9610	26.9652	26.9693	27.0113	27.0533	27.0954
1900	26.9568	28.5413	28.5455	28.5498	28.5924	28.6352	28.6779
2000	28.5370	30.1290	30.1333	30.1376	30.1808	30.2241	30.2674
2100	30.1246	31.7230	31.7274	31.7318	31.7755	31.8193	31.8632
2200	31.7187	33.3231	33.3275	33.3319	33.3761	33.4203	33.4647
2300	33.3187	34.9284	34.9329	34.9374	34.9819	35.0266	35.0712
2400	34.9240	36.5387	36.5432	36.5477	36.5926	36.6377	36.6827
2500	36.5342	38.1533	38.1579	38.1624	38.2076	38.2530	38.2983
2600	38.1488	39.7722	39.7767	39.7813	39.8268	39.8723	39.9179
2700	39.7676	41.3947	41.3993	41.4039	41.4496	41.4954	41.5413
2800	41.3901	43.0206	43.0252	43.0298	43.0758	43.1218	43.1678
2900	43.0160	44.6499	44.6545	44.6591	44.7053	44.7514	44.7976
3000	44.6452	46.2810	46.2856	46.2902	46.3366	46.3831	46.4297

TABLE 4h-23. COMPRESSIBILITY FACTOR FOR OXYGEN,  
 $Z = PV/RT$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	0.97724	0.98796	0.97880	0.96956	0.8734	0.7764	0.6871
200	0.99701	0.99759	0.99580	0.99402	0.97731	0.9636	0.9541
300	0.99939	1.00006	1.00012	1.00019	1.00161	1.0042	1.0079
400	1.00001	1.00088	1.00154	1.00222	1.00942	1.0173	1.0256
500	1.00022	1.00116	1.00204	1.00292	1.01205	1.0216	1.0314
600	1.00029	1.00124	1.00218	1.00312	1.01275	1.0227	1.0328
700	1.00031	1.00124	1.00218	1.00311	1.01265	1.0224	1.0323
800	1.00031	1.00124	1.00218	1.00311	1.01265	1.0224	1.0323
900	1.00030	1.00121	1.00211	1.00302	1.01223	1.0216	1.0312
1000	1.00029	1.00115	1.00202	1.00288	1.01167	1.0206	1.0296
1100	1.00027	1.00109	1.00192	1.00274	1.01107	1.0195	1.0281
1200	1.00026	1.00104	1.00182	1.00260	1.01047	1.0184	1.0265
1300	1.00025	1.00098	1.00172	1.00246	1.00991	1.0174	1.0250
1400	1.00023	1.00093	1.00163	1.00233	1.00938	1.0165	1.0237
1500	1.00022	1.00088	1.00155	1.00221	1.00890	1.0156	1.0224
1600	1.00021	1.00084	1.00147	1.00210	1.00845	1.0149	1.0213
1700	1.00020	1.00080	1.00140	1.00200	1.00803	1.0141	1.0202
1800	1.00019	1.00076	1.00133	1.00190	1.00765	1.0134	1.0193
1900	1.00018	1.00072	1.00127	1.00181	1.00728	1.0128	1.0183
2000	1.00017	1.00069	1.00121	1.00173	1.00696	1.0122	1.0175
2100	1.00017	1.00066	1.00116	1.00166	1.00666	1.0117	1.0167
2200	1.00016	1.00063	1.00111	1.00159	1.00638	1.0112	1.0161
2300	1.00015	1.00061	1.00107	1.00152	1.00610	1.0107	1.0153
2400	1.00015	1.00058	1.00102	1.00146	1.00586	1.0103	1.0147
2500	1.00014	1.00056	1.00098	1.00141	1.00564	1.0099	1.0142
2600	1.00014	1.00054	1.00095	1.00135	1.00543	1.0095	1.0136
2700	1.00013	1.00052	1.00091	1.00130	1.00523	1.0092	1.0131
2800	1.00013	1.00050	1.00088	1.00126	1.00505	1.0089	1.0127
2900	1.00012	1.00049	1.00085	1.00122	1.00488	1.0086	1.0122
3000	1.00012	1.00047	1.00082	1.00117	1.00471	1.0083	1.0118

TABLE 4h-24. RELATIVE DENSITY OF OXYGEN,  $\rho/\rho_0$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	2.79257	5.4245	9.7584	14.073	62.4	123	198.5
200	1.36860	3.6474	6.39455	9.151	37.231	66.082	95.34
300	0.91023	2.72885	4.77519	6.8212	27.246	47.557	67.69
400	0.65225	2.18129	3.31474	5.4459	21.628	37.556	53.217
500	0.54568	1.81723	3.17736	4.5351	17.9767	31.165	44.098
600	0.45470	1.55750	2.72307	3.8864	15.3980	26.684	37.747
700	0.38974	1.36282	2.38269	3.4006	13.4746	23.355	33.045
800	0.34102	1.21143	2.11809	3.0231	11.9823	20.776	29.404
900	0.30313	1.09035	1.90646	2.7211	10.7901	18.717	26.505
1000	0.27282	0.99129	1.73331	2.4741	9.8150	17.034	24.131
1100	0.24802	0.90872	1.58903	2.26828	9.0024	15.631	22.154
1200	0.22736	0.83887	1.46694	2.09409	8.3145	14.443	20.480
1300	0.20987	0.77899	1.36228	1.94476	7.7247	13.423	19.041
1400	0.19488	0.72710	1.27157	1.81533	7.2131	12.539	17.794
1500	0.18189	0.68168	1.19219	1.70206	6.7653	11.764	16.700
1600	0.17053	0.64161	1.12214	1.60210	6.3700	11.080	15.735
1700	0.16050	0.60599	1.05987	1.51324	6.0184	10.472	14.874
1800	0.15158	0.57412	1.00415	1.43373	5.7037	9.927	14.105
1900	0.14361	0.54543	0.95400	1.36215	5.4202	9.436	13.410
2000	0.13643	0.51947	0.90862	1.29737	5.1637	8.991	12.781
2100	0.12993	0.49587	0.87306	1.23849	4.9303	8.587	12.208
2200	0.12403	0.47432	0.82968	1.18473	4.7173	8.217	11.686
2300	0.11863	0.45457	0.79515	1.13543	4.5218	7.878	11.206
2400	0.11369	0.43640	0.76337	1.09007	4.3419	7.566	10.763
2500	0.10915	0.41962	0.73404	1.04820	4.1758	7.278	10.355
2600	0.10495	0.40409	0.70688	1.00943	4.0219	7.010	9.976
2700	0.10106	0.38966	0.68165	0.97342	3.8790	6.762	9.624
2800	0.09745	0.37623	0.65817	0.93989	3.7458	6.531	9.296
2900	0.09409	0.36370	0.63625	0.90861	3.6216	6.315	8.990
3000	0.09096	0.35216	0.61617	0.87943	3.5043	6.104	8.700



TABLE 4h-25. SPECIFIC HEAT OF OXYGEN,  $C_p/R$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
200	3.519	3.5681	3.6196	3.6739	4.415	5.06	7.6
300	3.503	3.5584	3.5766	3.5951	3.7862	3.981	4.165
400	3.6243	3.6335	3.6427	3.6520	3.7453	3.836	3.921
500	3.7415	3.7470	3.7526	3.7582	3.8134	3.8677	3.920
600	3.8611	3.8648	3.8685	3.8722	3.9087	3.9445	3.980
700	3.9681	3.9707	3.9733	3.9759	4.0016	4.0266	4.052
800	4.0583	4.0603	4.0622	4.0641	4.0830	4.1017	4.120
900	4.1332	4.1347	4.1361	4.1376	4.1521	4.1664	4.180
1000	4.1952	4.1964	4.1975	4.1987	4.2101	4.2213	4.232
1100	4.2472	4.2481	4.2491	4.2500	4.2591	4.2681	4.277
1200	4.2915	4.2922	4.2930	4.2937	4.3012	4.3085	4.316
1300	4.3302	4.3308	4.3315	4.3321	4.3382	4.3442	4.350
1400	4.3653	4.3658	4.3663	4.3669	4.3721	4.3771	4.382
1500	4.3976	4.3981	4.3985	4.3990	4.4034	4.4076	4.412
1600	4.4283	4.4287	4.4291	4.4295	4.4332	4.4369	4.440
1700	4.4579	4.4582	4.4586	4.4589	4.4621	4.4652	4.468
1800	4.4869	4.4872	4.4875	4.4878	4.4905	4.4933	4.496
1900	4.5154	4.5156	4.5159	4.5161	4.5185	4.5209	4.523
2000	4.5437	4.5439	4.5441	4.5443	4.5464	4.5485	4.551
2100	4.5716	4.5717	4.5719	4.5721	4.5739	4.5758	4.578
2200	4.5993	4.5995	4.5997	4.5999	4.6016	4.6032	4.605
2300	4.6268	4.6269	4.6271	4.6272	4.6287	4.6301	4.631
2400	4.6540	4.6543	4.6543	4.6544	4.6558	4.6570	4.658
2500	4.6808	4.6810	4.6811	4.6812	4.6824	4.6835	4.685
2600	4.7071	4.7072	4.7073	4.7074	4.7085	4.7095	4.710
2700	4.7328	4.7329	4.7330	4.7331	4.7341	4.7349	4.736
2800	4.7579	4.7580	4.7581	4.7582	4.7590	4.7598	4.761
2900	4.7824	4.7825	4.7826	4.7826	4.7834	4.7841	4.785
3000	4.8062	4.8063	4.8064	4.8064	4.8072	4.8077	4.808

TABLE 4h-26. ENTHALPY OF OXYGEN,  $(H - E_0^\circ)/RT_0$

T, K	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	1.254	2.5308	2.5091	2.4871	2.248	1.972	1.659
200	2.5523	3.8319	3.8213	3.8108	3.705	3.602	3.505
300	3.8424	5.1464	5.1406	5.1349	5.078	5.023	4.971
400	5.1523	6.4968	6.4936	6.4905	6.400	6.431	6.403
500	6.5000	7.8903	7.8888	7.8873	7.873	7.860	7.848
600	7.8919	9.3250	9.3245	9.3242	9.321	9.319	9.318
700	9.3254	10.7956	10.7960	10.7965	10.802	10.807	10.814
800	10.7951	12.2960	12.2970	12.2981	12.309	12.321	12.333
900	12.2949	13.8213	13.8228	13.8243	13.840	13.857	13.874
1000	13.8198	15.3672	15.3691	15.3710	15.391	15.411	15.431
1100	15.3653	16.9307	16.9329	16.9351	16.958	16.981	17.004
1200	16.9285	18.5092	18.5116	18.5141	18.539	18.565	18.591
1300	18.5067	20.1012	20.1038	20.1065	20.134	20.161	20.189
1400	20.0985	21.7054	21.7082	21.7111	21.740	21.769	21.799
1500	21.7025	23.3211	23.3241	23.3271	23.358	23.388	23.419
1600	23.3181	24.9479	24.9510	24.9541	24.986	25.018	25.050
1700	24.9447	26.5852	26.5885	26.5917	26.625	26.658	26.691
1800	26.5820	28.2333	28.2366	28.2399	28.274	28.308	28.342
1900	28.2299	29.8915	29.8949	29.8983	29.933	29.968	30.003
2000	29.8880	31.5601	31.5636	31.5671	31.602	31.638	31.674
2100	31.5566	33.2424	33.2460	33.2496	33.282	33.318	33.355
2200	33.2353	34.9348	34.9312	34.9348	34.971	35.008	35.045
2300	34.9239	36.6266	36.6303	36.6340	36.671	36.708	36.745
2400	36.6229	38.3352	38.3389	38.3426	38.380	38.418	38.455
2500	38.3314	40.0500	40.0575	40.0613	40.099	40.137	40.175
2600	40.0500	41.7816	41.7854	41.7892	41.827	41.866	41.904
2700	41.7778	43.5189	43.5227	43.5266	43.565	43.604	43.643
2800	43.5151	45.2653	45.2691	45.2730	45.312	45.351	45.390
2900	45.2514	47.0204	47.0243	47.0282	47.067	47.107	47.146
3000	47.0165						

TABLE 4h-27. ENTROPY OF OXYGEN,  $S/R$ 

$T, K$	1 atm	4 atm	7 atm	10 atm	40 atm	70 atm	100 atm
100	20.794						
200	23.2553	21.8488	21.2686	20.8908	19.2709	18.431	17.74
300	24.6839	23.2899	22.7224	22.3579	20.8928	20.2555	19.825
400	25.7127	24.3224	23.7587	23.3980	21.9719	21.3733	20.9789
500	26.5337	25.1450	24.5830	24.2239	22.8139	22.2311	21.8517
600	27.2266	25.8387	25.2775	24.9193	23.5176	22.9429	22.5712
700	27.8299	26.4425	25.8819	25.5241	24.1272	23.5571	23.1900
800	28.3659	26.9788	26.4185	26.0610	24.6670	24.0999	23.7357
900	28.8484	27.4615	26.9013	26.5440	25.1521	24.5869	24.2246
1000	29.2872	27.9005	27.3404	26.9833	25.5926	25.0287	24.6678
1100	29.6896	28.3029	27.7430	27.3859	25.9963	25.4334	25.0733
1200	30.0610	28.6744	28.1146	27.7576	26.3685	25.8004	25.4471
1300	30.4061	29.0196	28.4598	28.1029	26.7144	26.1527	25.7939
1400	30.7283	29.3419	28.7821	28.4252	27.0372	26.4760	26.1176
1500	31.0307	29.6442	29.0845	28.7276	27.3399	26.7790	26.4209
1600	31.3155	29.9290	29.3693	29.0125	27.6250	27.0644	26.7067
1700	31.5848	30.1984	29.6387	29.2819	27.8946	27.3342	26.9766
1800	31.8404	30.4540	29.8943	29.5375	28.1505	27.5902	27.2328
1900	32.0838	30.6974	30.1377	29.7810	28.3941	27.8339	27.4767
2000	32.3161	30.9297	30.3701	30.0133	28.6265	28.0664	27.7094
2100	32.5385	31.1521	30.5925	30.2358	28.8490	28.2890	27.9320
2200	32.7518	31.3655	30.8058	30.4491	29.0625	28.5025	28.1456
2300	32.9568	31.5705	31.0108	30.6541	29.2675	28.7077	28.3508
2400	33.1543	31.7680	31.2083	30.8516	29.4651	28.9053	28.5485
2500	33.3449	31.9586	31.3990	31.0422	29.6558	29.0960	28.7393
2600	33.5289	32.1426	31.5830	31.2263	29.8399	29.2802	28.9235
2700	33.7071	32.3208	31.7612	31.4045	30.0181	29.4585	29.1018
2800	33.8796	32.4933	31.9337	31.5770	30.1907	29.6310	29.2744
2900	34.0470	32.6607	32.1011	31.7444	30.3581	29.7985	29.4419
3000	34.2096	32.8233	32.2637	31.9070	30.5207	29.9612	29.6047

TABLE 4h-28. THERMODYNAMIC PROPERTIES OF IONIZED AIR  
 $T = 4000 \text{ K}$ 

$\log \rho/\rho_0$	$Z$	$E/RT$	$H/RT$	$S/R$	$\log_{10} P, \text{ atm}$	$Z^*$
-5.00	1.27113	7.98674	9.25788	50.3307	-3.72990	1.27113
-4.80	1.25871	7.63908	8.89779	49.4006	-3.53416	1.25871
-4.60	1.24863	7.35804	8.60667	48.5423	-3.33765	1.24863
-4.40	1.24045	7.13130	8.37175	47.7425	-3.14051	1.24045
-4.20	1.23380	6.94846	8.18225	46.9900	-2.94284	1.23379
-4.00	1.22834	6.80080	8.02914	46.2755	-2.74477	1.22834
-3.80	1.22381	6.68107	7.90488	45.5912	-2.54637	1.22381
-3.60	1.21997	6.58320	7.80317	44.9306	-2.34774	1.21997
-3.40	1.21662	6.50204	7.71866	44.2884	-2.14893	1.21662
-3.20	1.21356	6.43313	7.64669	43.6600	-1.95003	1.21356
-3.00	1.21060	6.37242	7.58303	43.0411	-1.75108	1.21060
-2.80	1.20755	6.31608	7.52363	42.4279	-1.55218	1.20755
-2.60	1.20419	6.26016	7.46434	41.8167	-1.35339	1.20418
-2.40	1.20024	6.20044	7.40068	41.2033	-1.15482	1.20024
-2.20	1.19544	6.13223	7.32767	40.5834	-0.95656	1.19543
-2.00	1.18943	6.05042	7.23985	39.9524	-0.75875	1.18941
-1.80	1.18189	5.94985	7.13174	39.3058	-0.56151	1.18187
-1.60	1.17257	5.82615	6.99871	38.6399	-0.36495	1.17252
-1.40	1.16133	5.67706	6.83930	37.9533	-0.16913	1.16127
-1.20	1.14833	5.50363	6.65196	37.2480	0.02598	1.14822
-1.00	1.13396	5.31076	6.44471	36.5296	0.22051	1.13380
-0.80	1.11884	5.10642	6.22526	35.8065	0.41468	1.11859
-0.60	1.10369	4.90000	6.00369	35.0884	0.60876	1.10330
-0.40	1.08918	4.70034	5.78952	34.3839	0.80301	1.08856
-0.20	1.07585	4.51438	5.59022	33.6994	0.99766	1.07488
0.	1.06407	4.34655	5.41062	33.0390	1.19288	1.06256
0.20	1.05411	4.19894	5.25305	32.4037	1.38880	1.05174
0.40	1.04615	4.07180	5.11795	31.7931	1.58551	1.04242
0.60	1.04038	3.96410	5.00448	31.2050	1.78311	1.03453
0.80	1.03713	3.87406	4.91120	30.6367	1.98175	1.02791
1.00	1.03695	3.79961	4.83656	30.0848	2.18167	1.02242
1.20	1.04079	3.73861	4.77940	29.5456	2.38328	1.01787
1.40	1.05028	3.68908	4.73936	29.0148	2.58722	1.01412
1.60	1.06811	3.64930	4.71741	28.4877	2.79453	1.01100
1.80	1.09856	3.61790	4.71646	27.9580	3.00674	1.00837
2.00	1.14848	3.59393	4.74241	27.4175	3.22604	1.00606

$Z^*$  is the number of moles of dissociated gas corresponding to one mole of low-temperature gas.

TABLE 4h-28. THERMODYNAMIC PROPERTIES OF IONIZED AIR (Continued)

 $T = 6000 \text{ K}$ 

$\log p/p_0$	$Z$	$E/RT$	$H/RT$	$S/R$	$\log_{10} P, \text{ atm}$	$Z^*$
-5.00	1.98639	19.99067	21.97706	68.7753	-3.35993	1.98639
-4.80	1.98008	19.86188	21.84196	67.7331	-3.16131	1.98008
-4.60	1.97116	19.68615	21.65732	66.6475	-2.96327	1.97117
-4.40	1.95832	19.43841	21.39673	65.4048	-2.76611	1.95832
-4.20	1.93995	19.08795	21.02790	64.2465	-2.57021	1.93995
-4.00	1.91430	18.60197	20.51627	62.8727	-2.37599	1.91430
-3.80	1.87994	17.95327	19.83321	61.3500	-2.18385	1.87994
-3.60	1.83631	17.13119	18.96749	59.6719	-1.99405	1.83631
-3.40	1.78420	16.15055	17.93475	57.8573	-1.80655	1.78420
-3.20	1.72580	15.05251	16.77831	55.9509	-1.62100	1.72580
-3.00	1.66421	13.89543	15.55964	54.0131	-1.43679	1.66421
-2.80	1.60268	12.74058	14.34326	52.1061	-1.25315	1.60268
-2.60	1.54398	11.63995	13.18393	50.2811	-1.06935	1.54398
-2.40	1.49003	10.62989	12.11991	48.5727	-0.88480	1.49002
-2.20	1.44187	9.73045	11.17232	46.9984	-0.69907	1.44186
-2.00	1.39984	8.94817	10.34801	45.5620	-0.51192	1.39983
-1.80	1.36376	8.27996	9.64372	44.2577	-0.32326	1.36373
-1.60	1.33312	7.71677	9.04989	43.0737	-0.13313	1.33307
-1.40	1.30722	7.24649	8.55371	41.9956	0.05835	1.30715
-1.20	1.28534	6.85589	8.14122	41.0082	0.25102	1.28522
-1.00	1.26671	6.53186	7.79857	40.0967	0.44468	1.26653
-0.80	1.25062	6.26209	7.51271	39.2473	0.63913	1.25035
-0.60	1.23641	6.03531	7.27172	38.4480	0.83417	1.23598
-0.40	1.22347	5.84143	7.06490	37.6877	1.02960	1.22280
-0.20	1.21125	5.67145	6.88270	36.9572	1.22524	1.21020
0.	1.19932	5.51750	6.71682	36.2482	1.42094	1.19767
0.20	1.18737	5.37295	6.56032	35.5541	1.61659	1.18478
0.40	1.17526	5.23261	6.40787	34.8697	1.81214	1.17121
0.60	1.16316	5.09308	6.25624	34.1918	2.00765	1.15683
0.80	1.15159	4.95296	6.10456	33.5187	2.20330	1.14169
1.00	1.14152	4.81288	5.95440	32.8507	2.39949	1.12605
1.20	1.13147	4.67497	5.80944	32.1889	2.59680	1.11030
1.40	1.12262	4.54223	5.67485	31.5344	2.79609	1.09487
1.60	1.113913	4.41768	5.55681	30.8872	2.99858	1.08015
1.80	1.105861	4.30382	5.46243	30.2449	3.20594	1.06639
2.00	1.19794	4.20247	5.40041	29.6019	3.42044	1.05372

TABLE 4h-28. THERMODYNAMIC PROPERTIES OF IONIZED AIR (Continued)  
 $T = 8000 \text{ K}$ 

$\log \rho/\rho_0$	$Z$	$E/RT$	$H/RT$	$S/R$	$\log_{10} P, \text{ atm}$	$Z^*$
-5.00	2.17208	20.12586	22.29794	74.4276	-3.19618	2.17228
-4.80	2.13622	19.32981	21.46602	72.6399	-3.00341	2.13640
-4.60	2.10717	18.68526	20.79243	71.0185	-2.80936	2.10733
-4.40	2.08370	18.16490	20.24859	69.5334	-2.61422	2.08385
-4.20	2.06474	17.74534	19.81007	68.1587	-2.41819	2.06487
-4.00	2.04939	17.40674	19.45612	66.8730	-2.22143	2.04950
-3.80	2.03685	17.13225	19.16910	65.6577	-2.02410	2.03696
-3.60	2.02645	16.90733	18.93378	64.4973	-1.82632	2.02654
-3.40	2.01753	16.71903	18.73656	63.3778	-1.62824	2.01761
-3.20	2.00945	16.55509	18.56455	62.2867	-1.42908	2.00953
-3.00	2.00151	16.40300	18.40452	61.2110	-1.23170	2.00158
-2.80	1.99288	16.24878	18.24166	60.1370	-1.03358	1.99293
-2.60	1.98248	16.07573	18.05820	59.0485	-0.83585	1.98252
-2.40	1.96897	15.86333	17.83229	57.9262	-0.63882	1.96900
-2.20	1.95069	15.58703	17.53772	56.7471	-0.44287	1.95072
-2.00	1.92584	15.22003	17.14587	55.4872	-0.24844	1.92585
-1.80	1.89274	14.73824	16.63098	54.1259	-0.05597	1.89273
-1.60	1.85048	14.12817	15.97865	52.6536	0.13423	1.85044
-1.40	1.79940	13.39465	15.19404	51.0793	0.32207	1.79932
-1.20	1.74129	12.56340	14.30470	49.4326	0.50782	1.74116
-1.00	1.67906	11.67587	13.35493	47.7575	0.69201	1.67884
-0.80	1.61594	10.77874	12.39468	46.1017	0.87537	1.61566
-0.60	1.55484	9.91370	11.46854	44.5068	1.05863	1.55432
-0.40	1.49788	9.11130	10.60918	43.0017	1.24242	1.49708
-0.20	1.44632	8.38943	9.83575	41.6021	1.42721	1.44509
0.	1.40063	7.75491	9.15555	40.3123	1.61327	1.39875
0.20	1.36078	7.20639	8.56717	39.1282	1.80073	1.35789
0.40	1.32640	6.73723	8.06362	38.0405	1.98962	1.32195
0.60	1.29703	6.33794	7.63497	37.0374	2.17989	1.29017
0.80	1.27233	5.99796	7.27029	36.1060	2.37154	1.26172
1.00	1.25222	5.70678	6.95900	35.2337	2.56462	1.23578
1.20	1.23714	5.45484	6.69197	34.4088	2.75936	1.21162
1.40	1.22829	5.23393	6.46222	33.6205	2.95625	1.18866
1.60	1.22807	5.03758	6.26565	32.8590	3.15617	1.16650
1.80	1.24054	4.86115	6.10169	32.1147	3.36056	1.14487
2.00	1.27229	4.70179	5.97408	31.3777	3.57153	1.12367

TABLE 4h-28. THERMODYNAMIC PROPERTIES OF IONIZED AIR (Continued)

 $T = 10,000 \text{ K}$ 

$\log p/p_0$	$Z$	$E/RT$	$H/RT$	$S/R$	$\log_{10} P, \text{ atm}$	$Z^*$
-5.00	3.13590	34.42541	37.56131	94.5501	-2.93978	3.13820
-4.80	2.98152	31.65851	34.64003	90.3748	-2.76171	2.98385
-4.60	2.83477	29.02681	31.86158	86.4040	-2.58363	2.83708
-4.40	2.70080	26.61470	29.31506	82.7180	-2.40472	2.70260
-4.20	2.58086	24.46888	27.04974	79.3568	-2.22433	2.58300
-4.00	2.47709	22.60469	25.08178	76.3287	-2.04220	2.47911
-3.80	2.38866	21.01522	23.40333	73.6195	-1.85799	2.39054
-3.60	2.31438	19.67975	21.99413	71.2017	-1.67171	2.31612
-3.40	2.25270	18.57046	20.82315	69.0413	-1.48344	2.25430
-3.20	2.20192	17.65711	19.85903	67.1026	-1.29335	2.20338
-3.00	2.16037	16.90999	19.07036	65.3514	-1.10162	2.16169
-2.80	2.12649	16.30150	18.42800	63.7561	-0.90848	2.12769
-2.60	2.09889	15.80687	17.90577	62.2888	-0.71416	2.09997
-2.40	2.07632	15.40423	17.48055	60.9250	-0.51885	2.07729
-2.20	2.05764	15.07428	17.13192	59.6433	-0.32278	2.05850
-2.00	2.04181	14.79967	16.84149	58.4248	-0.12613	2.04258
-1.80	2.02780	14.56421	16.59201	57.2524	0.07088	2.02847
-1.60	2.01453	14.35175	16.36629	56.1091	0.26803	2.01510
-1.40	2.00076	14.14511	15.14587	54.9779	0.46505	2.00123
-1.20	1.98502	13.92488	15.00000	53.8308	0.66162	1.98536
-1.00	1.96556	13.66889	15.63445	52.6740	0.85734	1.96575
-0.80	1.94043	13.35298	15.29341	51.4585	1.05175	1.94041
-0.60	1.90775	12.95423	14.86198	50.1733	1.24437	1.90744
-0.40	1.86624	12.45686	14.32310	48.8066	1.43482	1.86553
-0.20	1.81580	11.85896	13.67475	47.3606	1.62292	1.81450
0.	1.75782	11.17605	12.93388	45.8546	1.80883	1.75507
0.20	1.69501	10.43853	12.13354	44.3219	1.99303	1.69159
0.40	1.63071	9.68368	11.31439	42.8013	2.17623	1.62540
0.60	1.56819	8.94681	10.51500	41.3280	2.35925	1.56007
0.80	1.51018	8.25507	9.76525	39.9277	2.54288	1.49781
1.00	1.45879	7.62528	9.08407	38.6146	2.72785	1.44000
1.20	1.41573	7.06479	8.48053	37.3925	2.91484	1.38714
1.40	1.38272	6.57376	7.95649	36.2576	3.10459	1.33914
1.60	1.36208	6.14771	7.50979	35.2001	3.29806	1.29550
1.80	1.35741	5.77984	7.13726	34.2067	3.49657	1.25553
2.00	1.37455	5.46289	6.83744	33.2617	3.70201	1.21845

TABLE 4h-28. THERMODYNAMIC PROPERTIES OF IONIZED AIR (Continued)

 $T = 12,000$  K

$\log \rho/\rho_0$	$Z$	$E/RT$	$H/RT$	$S/R$	$\log_{10} P, \text{ atm}$	$Z^*$
-5.00	3.86391	40.69274	44.55665	107.9424	-2.76994	3.86758
-4.80	3.80741	39.84992	43.65733	105.3326	-2.57633	3.81182
-4.60	3.73923	38.69570	42.42592	102.4419	-2.38523	3.73543
-4.40	3.63912	37.19560	40.82571	99.2462	-2.19704	3.63612
-4.20	3.50778	35.35895	38.86673	95.7652	-2.01193	3.51451
-4.00	3.36735	33.24726	36.61461	92.0699	-1.82968	3.37468
-3.80	3.21572	30.96381	34.17953	88.2705	-1.64969	3.22348
-3.60	3.06089	28.62933	31.69022	84.4904	-1.47112	3.06888
-3.40	2.91034	26.35611	29.26645	80.8427	-1.29302	2.91837
-3.20	2.76976	24.23093	27.00969	77.4102	-1.11452	2.77766
-3.00	2.64278	22.30907	24.95185	74.2427	-0.93490	2.65040
-2.80	2.53107	20.61675	23.14782	71.3597	-0.75366	2.53833
-2.60	2.43486	19.15766	21.59252	68.7570	-0.57049	2.44169
-2.40	2.35334	17.92033	20.27367	66.4186	-0.38528	2.35970
-2.20	2.28514	16.88443	19.16957	64.3152	-0.19805	2.29103
-2.00	2.22802	16.02552	18.25414	62.4174	-0.00893	2.23402
-1.80	2.18207	15.31821	17.50028	60.6949	0.18190	2.18700
-1.60	2.14383	14.73796	16.88179	59.1189	0.37422	2.14830
-1.40	2.11234	14.26199	16.37433	57.6631	0.56780	2.11636
-1.20	2.08614	13.86943	15.95557	56.3040	0.76238	2.08973
-1.00	2.06387	13.54099	15.60486	55.0202	0.95772	2.06701
-0.80	2.04413	13.25829	15.30243	53.7916	1.15354	2.04681
-0.60	2.02548	13.00293	15.02840	52.5992	1.34956	2.02762
-0.40	2.00628	12.75541	14.76169	51.4233	1.54543	2.00777
-0.20	1.98469	12.49447	14.47916	50.2433	1.74073	1.98533
0.	1.95864	12.19723	14.15587	49.0379	1.93499	1.95812
0.20	1.92615	11.84127	13.76742	47.7871	2.12773	1.92397
0.40	1.88572	11.40910	13.29482	46.4769	2.31851	1.88113
0.60	1.83703	10.89385	12.73008	45.1043	2.50715	1.82890
0.80	1.78138	10.30382	12.08519	43.6808	2.69379	1.76804
1.00	1.72172	9.66068	11.38239	42.2310	2.87900	1.70072
1.20	1.66222	8.99461	10.65683	40.7858	3.06372	1.62987
1.40	1.60767	8.33607	9.94374	39.3747	3.24923	1.55847
1.60	1.56321	7.70993	9.27314	38.0189	3.43705	1.48888
1.80	1.53453	7.13311	8.66764	36.7296	3.62901	1.42261
2.00	1.52846	6.61560	8.14406	35.5078	3.82729	1.36034

TABLE 4h-28. THERMODYNAMIC PROPERTIES OF IONIZED AIR (Continued)

 $T = 14,000 \text{ K}$ 

$\log \rho/\rho_0$	$Z$	$E/RT$	$H/RT$	$S/R$	$\log_{10} P, \text{ atm}$	$Z^*$
-5.00	3.96453	37.19404	41.15858	110.4755	-2.69183	3.96768
-4.80	3.95531	37.07956	41.03487	108.5372	-2.49284	3.95924
-4.60	3.94140	36.90620	40.84760	106.5454	-2.29437	3.94630
-4.40	3.92053	36.64408	40.56461	104.4727	-2.09667	3.92661
-4.20	3.88963	36.25307	40.14270	102.2829	-1.90011	3.89710
-4.00	3.84491	35.68344	39.52835	99.9317	-1.70513	3.85400
-3.80	3.78231	34.88151	38.66382	97.3728	-1.51226	3.79320
-3.60	3.69844	33.80203	37.50047	94.5700	-1.32200	3.71123
-3.40	3.59192	32.42548	36.01739	91.5140	-1.13469	3.60657
-3.20	3.46445	30.77278	34.23723	88.2358	-0.95038	3.48078
-3.00	3.32103	28.90780	32.22884	84.8080	-0.76874	3.33872
-2.80	3.16891	26.92442	30.09333	81.3301	-0.58911	3.18754
-2.60	3.01587	24.92472	27.94059	77.9061	-0.41061	3.03498
-2.40	2.86883	22.99891	25.86775	74.6258	-0.23231	2.88800
-2.20	2.73281	21.21359	23.94640	71.5512	-0.05341	2.75165
-2.00	2.61079	19.60888	22.21968	68.7168	0.12675	2.62901
-1.80	2.50400	18.20170	20.70570	66.1325	0.30862	2.52138
-1.60	2.41233	16.99150	19.40383	63.7909	0.49242	2.42872
-1.40	2.33481	15.96627	18.30108	61.6732	0.67823	2.35013
-1.20	2.26997	15.10755	17.37752	59.7547	0.86600	2.28418
-1.00	2.21612	14.39394	16.61006	58.0086	1.05558	2.22920
-0.80	2.17154	13.80342	15.97497	56.4081	1.24675	2.18348
-0.60	2.13453	13.31458	15.44911	54.9280	1.43928	2.14528
-0.40	2.10343	12.90702	15.01045	53.5449	1.63291	2.11293
-0.20	2.07663	12.56120	14.63783	52.2367	1.82734	2.08474
0.	2.05249	12.25780	14.31028	50.9826	2.02226	2.05892
0.20	2.02925	11.97699	14.00624	49.7620	2.21732	2.03354
0.40	2.00501	11.69771	13.70272	48.5537	2.41210	2.00640
0.60	1.97779	11.39771	13.37551	47.3365	2.60616	1.97505
0.80	1.94576	11.05510	13.00095	46.0904	2.79907	1.93701
1.00	1.90776	10.65244	12.56020	44.8001	2.99050	1.89018
1.20	1.86404	10.18093	12.04497	43.4599	3.18044	1.83349
1.40	1.81692	9.64525	11.46216	42.0767	3.36932	1.76732
1.60	1.77093	9.06324	10.83417	40.6687	3.55818	1.69358
1.80	1.73261	8.46230	10.19491	39.2615	3.74868	1.61516
2.00	1.70947	7.87630	9.58577	37.8837	3.94284	1.53540



TABLE 4h-29. THERMODYNAMIC PROPERTIES OF NITROGEN  
T = 4000 K

$\log \rho/\rho_0$	Z	Moles	E/RT	H/RT	S/R	$\log_{10} P$	N(E)†	$C_p/R$	$C_v/R$	a/a <sub>0</sub>
-5.0	1.07027	1.07027	5.1506	6.2209	44.3262	-3.8047	2.57 + 08	34.3362	30.3825	3.4994
-4.8	1.05623	1.05623	4.7552	5.8114	43.4412	-3.6104	3.00 + 08	28.4237	25.1844	3.4844
-4.6	1.04494	1.04493	4.4368	5.4817	42.6391	-3.4151	3.51 + 08	23.6420	20.9369	3.4752
-4.4	1.03586	1.03586	4.1811	5.2170	41.9044	-3.2189	4.13 + 08	19.7917	17.4869	3.4712
-4.2	1.02859	1.02859	3.9763	5.0049	41.2243	-3.0219	4.89 + 08	16.7015	14.6981	3.4716
-4.0	1.02278	1.02278	3.8124	4.8352	40.5882	-2.8244	5.82 + 08	14.2273	12.4520	3.4761
-3.8	1.01814	1.01814	3.6816	4.6998	39.9875	-2.6264	6.98 + 08	12.2500	10.6483	3.4839
-3.6	1.01444	1.01443	3.5773	4.5917	39.4151	-2.4279	8.41 + 08	10.6719	9.2031	3.4945
-3.4	1.01148	1.01148	3.4941	4.5056	38.8655	-2.2292	1.02 + 09	9.4138	8.0473	3.5073
-3.2	1.00913	1.00913	3.4278	4.4370	38.3340	-2.0302	1.25 + 09	8.4115	7.1241	3.5215
-3.0	1.00726	1.00726	3.3751	4.3824	37.8170	-1.8310	1.53 + 09	7.6136	6.3877	3.5365
-2.8	1.00577	1.00577	3.3331	4.3389	37.3115	-1.6317	1.88 + 09	6.9786	5.8008	3.5517
-2.6	1.00459	1.00459	3.2998	4.3044	36.8152	-1.4322	2.32 + 09	6.4736	5.3333	3.5665
-2.4	1.00365	1.00365	3.2732	4.2769	36.3263	-1.2326	2.88 + 09	6.0720	4.9612	3.5804
-2.2	1.00291	1.00290	3.2521	4.2550	35.8432	-1.0329	3.58 + 09	5.7527	4.6651	3.5932
-2.0	1.00232	1.00230	3.2354	4.2377	35.3647	-.8332	4.46 + 09	5.4989	4.4295	3.6048
-1.8	1.00185	1.00183	3.2220	4.2230	34.8909	-.6334	5.57 + 09	5.2972	4.2423	3.6140
-1.6	1.00149	1.00145	3.2114	4.2129	34.4180	-.4335	6.97 + 09	5.1369	4.0934	3.6236
-1.4	1.00121	1.00115	3.2030	4.2042	33.9485	-.2336	8.73 + 09	5.0095	3.9750	3.6311
-1.2	1.00101	1.00092	3.1963	4.1974	33.4808	-.0337	1.09 + 10	4.9083	3.8810	3.6375
-1.0	1.00087	1.00073	3.1910	4.1919	33.0145	.1662	1.37 + 10	4.8279	3.8062	3.6428
-.8	1.00081	1.00058	3.1868	4.1876	32.5494	.3662	1.72 + 10	4.7641	3.7469	3.6474
-.6	1.00082	1.00046	3.1835	4.1843	32.0852	.5662	2.17 + 10	4.7133	3.6997	3.6513
-.4	1.00094	1.00037	3.1808	4.1818	31.6216	.7662	2.72 + 10	4.6730	3.6622	3.6549
-.2	1.00121	1.00029	3.1787	4.1800	31.1585	.9664	3.42 + 10	4.6410	3.6325	3.6584
-.0	1.00168	1.00023	3.1771	4.1788	30.6957	1.1666	4.31 + 10	4.6155	3.6089	3.6622
.2	1.00249	1.00018	3.1758	4.1783	30.2330	1.3669	5.42 + 10	4.5953	3.5903	3.6667
.4	1.00379	1.00015	3.1749	4.1787	29.7701	1.5675	6.83 + 10	4.5793	3.5756	3.6727
.6	1.00590	1.00012	3.1742	4.1801	29.3067	1.7684	8.62 + 10	4.5666	3.5641	3.6812
.8	1.00926	1.00009	3.1738	4.1831	28.8423	1.9698	1.09 + 11	4.5566	3.5553	3.6940
1.0	1.01460	1.00007	3.1737	4.1883	28.3763	2.1721	1.38 + 11	4.5489	3.5488	3.7136
1.2	1.02308	1.00006	3.1740	4.1971	27.9076	2.3757	1.75 + 11	4.5430	3.5445	3.7440
1.4	1.03653	1.00005	3.1747	4.2113	27.4343	2.5814	2.23 + 11	4.5392	3.5424	3.7914
1.6	1.05786	1.00004	3.1762	4.2341	26.9539	2.7903	2.87 + 11	4.5379	3.5427	3.8658
1.8	1.09166	1.00003	3.1788	4.2704	26.4621	3.0039	3.73 + 11	4.5405	3.5463	3.9790
2.0	1.14526	1.00002	3.1829	4.3282	25.9522	3.2247	4.96 + 11	4.5505	3.5544	4.1560

† N(E) is the number of electrons per cm<sup>3</sup>, expressed in the form a + b, meaning a × 10<sup>b</sup>.

TABLE 4h-29. THERMODYNAMIC PROPERTIES OF NITROGEN (Continued)  
T = 6000 K

$\log \rho/\rho_0$	Z	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	1.98949	1.98949	21.9731	23.9626	67.4937	-3.3593	1.27 + 12	14.2250	11.4527	6.1982
-4.8	1.98000	1.98000	21.7840	23.7640	66.3905	-3.1614	1.59 + 12	16.9096	13.8083	6.1281
-4.6	1.96630	1.96630	21.5179	23.4842	65.2154	-2.9644	1.99 + 12	21.1530	17.5086	6.0481
-4.4	1.94649	1.94649	21.1387	23.0852	63.9350	-2.7688	2.48 + 12	27.3503	22.8446	5.9653
-4.2	1.91840	1.91840	20.6050	22.5234	62.5110	-2.5751	3.08 + 12	35.7322	29.9229	5.8809
-4.0	1.87992	1.87992	19.8771	21.7570	60.9081	-2.3939	3.81 + 12	46.0825	38.4326	5.7917
-3.8	1.82974	1.82974	18.9297	20.7595	59.1061	-2.1957	4.67 + 12	57.4674	47.4846	5.6933
-3.6	1.76801	1.76800	17.7661	19.5341	57.1136	-2.0106	5.68 + 12	68.2367	55.7094	5.5828
-3.4	1.69676	1.69676	16.4240	18.1207	54.9734	-1.8285	6.85 + 12	76.4862	61.7151	5.4604
-3.2	1.61954	1.61954	14.9701	16.5896	52.7557	-1.6487	8.20 + 12	80.7954	64.6166	5.3294
-3.0	1.54057	1.54056	13.4836	15.0242	50.5416	-1.4704	9.73 + 12	80.7463	64.2934	5.1948
-2.8	1.46376	1.46376	12.0382	13.5020	48.4046	-1.2926	1.15 + 13	76.9116	61.2648	5.0624
-2.6	1.39214	1.39213	10.6904	12.0825	46.3994	-1.1144	1.35 + 13	70.4385	56.3665	4.9371
-2.4	1.32757	1.32756	9.4755	10.8030	44.5585	-.9350	1.58 + 13	62.5714	50.4523	4.8220
-2.2	1.27091	1.27090	8.4095	9.6804	42.8945	-.7540	1.86 + 13	54.3400	44.2225	4.7211
-2.0	1.22225	1.22223	7.4938	8.7161	41.4051	-.5709	2.18 + 13	46.4481	38.1688	4.6336
-1.8	1.18114	1.18112	6.7204	7.9015	40.0785	-.3858	2.56 + 13	39.2959	32.5899	4.5599
-1.6	1.14688	1.14684	6.0755	7.2224	38.8970	-.1986	3.01 + 13	33.0555	27.6345	4.4906
-1.4	1.11861	1.11855	5.5434	6.6620	37.8443	-.0094	3.56 + 13	27.7517	23.3485	4.4516
-1.2	1.09549	1.09539	5.1078	6.2033	36.8990	.1815	4.24 + 13	23.3262	19.7134	4.4147
-1.0	1.07670	1.07655	4.7534	5.8301	36.0447	.3740	5.07 + 13	19.6816	16.6756	4.3877
-.8	1.06154	1.06130	4.4666	5.5281	35.2656	.5679	6.09 + 13	16.7080	14.1651	4.3693
-.6	1.04938	1.04901	4.2354	5.2847	34.5484	.7629	6.37 + 13	14.2982	12.1082	4.3586
-.4	1.03970	1.03912	4.0495	5.0892	33.8816	.9588	8.95 + 13	12.3549	10.4340	4.3545
-.2	1.03211	1.03120	3.9005	4.9326	33.2556	1.1556	1.09 + 14	10.7933	9.0784	4.3559
-.0	1.02629	1.02436	3.7812	4.8075	32.6624	1.3532	1.23 + 14	9.5418	7.9850	4.3622
.2	1.02204	1.01979	3.6859	4.7080	32.0956	1.5514	1.66 + 14	8.5406	7.1059	4.3728
.4	1.01930	1.01574	3.6100	4.6293	31.5496	1.7502	2.05 + 14	7.7407	6.4007	4.3876
.6	1.01813	1.01251	3.5494	4.5676	31.0200	1.9497	2.55 + 14	7.1022	5.8360	4.4067
.8	1.01881	1.00993	3.5014	4.5202	30.5030	2.1500	3.19 + 14	6.5927	5.3846	4.4314
1.0	1.02192	1.00787	3.4633	4.4853	29.9952	2.3513	4.00 + 14	6.1860	5.0240	4.4640
1.2	1.02845	1.00623	3.4334	4.4619	29.4934	2.5541	5.04 + 14	5.8613	4.7363	4.5088
1.4	1.04009	1.00492	3.4103	4.4504	28.9942	2.7590	6.39 + 14	5.6018	4.5071	4.5726
1.6	1.05954	1.00386	3.3930	4.4526	28.4938	2.9670	8.18 + 14	5.3946	4.3250	4.6663
1.8	1.09117	1.00301	3.3811	4.4723	27.9872	3.1798	1.06 + 15	5.2303	4.1815	4.8064
2.0	1.14194	1.00233	3.3745	4.5165	27.4674	3.3996	1.40 + 15	5.1030	4.0700	5.0712

$^\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-29. THERMODYNAMIC PROPERTIES OF NITROGEN (Continued)  
T = 8000 K

$\log \rho/\rho_0$	Z	Moles	E/RT	H/RT	S/R	$\log_{10} P$	N(E)†	$C_p/R$	$C_v/R$	a/a <sub>0</sub>
-5.0	2.18555	2.18576	21.9006	24.0862	73.4742	-3.1936	4.99 + 13	57.8164	49.5308	7.1542
-4.8	2.14878	2.14897	21.0770	23.2258	71.6529	-3.0009	6.35 + 13	47.9289	41.1283	7.1139
-4.6	2.11897	2.11914	20.4097	22.5287	70.0032	-2.8070	8.06 + 13	39.8826	34.2034	7.0883
-4.4	2.09484	2.09499	19.8705	21.9653	68.4939	-2.6120	1.02 + 14	33.3888	28.5537	7.0759
-4.2	2.07530	2.07544	19.4349	21.5102	67.0982	-2.4161	1.29 + 14	28.1914	23.9896	7.0749
-4.0	2.05938	2.05951	19.0820	21.1414	65.7936	-2.2194	1.63 + 14	24.0755	20.3459	7.0808
-3.8	2.04625	2.04636	18.7940	20.8402	64.5603	-2.0222	2.06 + 14	20.8709	17.4880	7.1001
-3.6	2.03514	2.03524	18.5549	20.5900	63.3814	-1.8245	2.61 + 14	18.4544	15.3165	7.1207
-3.4	2.02528	2.02537	18.3499	20.3751	62.2415	-1.6267	3.28 + 14	16.7528	13.7713	7.1408
-3.2	2.01589	2.01596	18.1643	20.1801	61.1254	-1.4287	4.14 + 14	15.7475	12.8372	7.1540
-3.0	2.00601	2.00607	17.9820	19.9880	60.0171	-1.2308	5.21 + 14	15.4825	12.5497	7.1526
-2.8	1.99447	1.99453	17.7843	19.7787	58.8981	-1.0333	6.55 + 14	16.0696	12.9991	7.1298
-2.6	1.97077	1.97081	17.5477	19.5274	57.7462	-0.8365	8.22 + 14	17.6847	14.3226	7.0828
-2.4	1.96000	1.96003	17.2436	19.2036	56.5348	-0.6409	1.03 + 15	20.5348	16.6689	7.0142
-2.2	1.93292	1.93295	16.8391	18.7720	55.2336	-0.4469	1.28 + 15	24.7702	20.1165	6.9286
-2.0	1.89629	1.89630	16.3009	18.1972	53.8133	-0.2552	1.59 + 15	30.3278	24.5437	6.8290
-1.8	1.84843	1.84841	15.6043	17.4527	52.2540	-0.0663	1.96 + 15	36.7543	29.5100	6.7156
-1.6	1.78897	1.78893	14.7437	16.5327	50.5555	.1195	2.41 + 15	43.1458	34.2040	6.5872
-1.4	1.71942	1.71934	13.7401	15.4595	48.7437	.3022	2.93 + 15	48.3501	37.9607	6.4446
-1.2	1.64295	1.64282	12.6385	14.2815	46.8678	.4825	3.54 + 15	51.3902	39.9739	6.2911
-1.0	1.56365	1.56347	11.4978	13.0014	44.9867	.6610	4.25 + 15	51.8380	40.1100	6.1325
-.8	1.48571	1.48538	10.3759	11.8616	43.1648	.8388	5.08 + 15	49.8989	38.5859	5.9753
-.6	1.41231	1.41182	9.3196	10.7320	41.4415	1.0168	6.06 + 15	46.1972	35.8563	5.8257
-.4	1.34571	1.34497	8.3601	9.7058	39.8472	1.1958	7.23 + 15	41.4889	32.4268	5.6885
-.2	1.28704	1.28599	7.5129	8.7999	38.3941	1.3765	8.62 + 15	36.4363	28.7324	5.5669
0	1.23664	1.23494	6.7815	8.0181	37.0820	1.5591	1.03 + 16	31.5133	25.0899	5.4626
.2	1.19427	1.19169	6.1611	7.3554	35.9022	1.7440	1.24 + 16	27.0023	21.6986	5.3764
.4	1.15944	1.15549	5.6422	6.8016	34.8416	1.9311	1.49 + 16	23.0350	18.6634	5.3084
.6	1.13161	1.12552	5.2127	6.3443	33.8849	2.1206	1.81 + 16	19.6429	16.0224	5.2586
.8	1.11031	1.10091	4.8602	5.9705	33.0164	2.3123	2.21 + 16	16.7982	13.7710	5.2277
1.0	1.09541	1.08081	4.5728	5.6683	32.2214	2.5064	2.71 + 16	14.4444	11.8803	5.2173
1.2	1.08722	1.06447	4.3397	5.4270	31.4860	2.7032	3.36 + 16	12.5140	10.3097	5.2308
1.4	1.08077	1.05122	4.1510	5.2389	30.7976	2.9020	4.20 + 16	10.9307	9.0151	5.2746
1.6	1.09618	1.04047	4.0004	5.0966	30.1442	3.1067	5.32 + 16	9.6596	7.9535	5.3591
1.8	1.11922	1.03174	3.8799	4.9991	29.5142	3.3158	6.84 + 16	8.6204	7.0855	5.5012
2.0	1.16221	1.02463	3.7852	4.9474	28.8951	3.5321	9.00 + 16	7.7781	6.3770	5.7266

† N(E) is the number of electrons per cm<sup>3</sup>, expressed in the form a + b, meaning a × 10<sup>b</sup>.

TABLE 4h-29. THERMODYNAMIC PROPERTIES OF NITROGEN (Continued)  
T = 10,000 K

$\log \rho/\rho_0$	Z	Moles	E/RT	H/RT	S/R	$\log_{10} P$	N(E)†	$C_p/R$	$C_v/R$	a/a <sub>0</sub>
-5.0	3.18098	3.18339	36.5970	39.7780	94.4282	-2.9337	3.18 + 14	149.0162	118.0254	9.6774
-4.8	3.02429	3.02674	33.7675	36.7918	90.1701	-2.7556	4.37 + 14	146.4103	115.6397	9.4318
-4.6	2.87425	2.87669	31.0574	33.9316	86.1022	-2.5777	5.92 + 14	137.4614	108.7631	9.1941
-4.4	2.73608	2.73845	28.5607	31.2968	82.3143	-2.3991	7.90 + 14	124.4353	98.9949	8.9726
-4.2	2.61275	2.61502	26.3910	28.9444	78.8549	-2.2191	1.04 + 15	109.5346	87.8303	8.7728
-4.0	2.50536	2.50750	24.3902	26.8956	75.7350	-2.0374	1.36 + 15	94.4607	76.4281	8.5980
-3.8	2.41365	2.41565	22.7319	25.1455	72.9447	-1.8536	1.77 + 15	80.3112	65.5650	8.4492
-3.6	2.33651	2.33836	21.3367	23.6732	70.4563	-1.6677	2.28 + 15	67.6674	55.6889	8.3260
-3.4	2.27238	2.27407	20.1766	22.4490	68.2355	-1.4797	2.93 + 15	56.7445	47.0036	8.2270
-3.2	2.21951	2.22106	19.2205	21.4400	66.2455	-1.2900	3.75 + 15	47.5314	39.5509	8.1504
-3.0	2.17619	2.17759	18.4376	20.6138	64.4508	-1.0985	4.79 + 15	39.8975	33.2769	8.0938
-2.8	2.14079	2.14206	17.7989	19.9397	62.8183	-.9057	6.10 + 15	33.6624	28.0792	8.0550
-2.6	2.11183	2.11297	17.2782	19.3900	61.3187	-.7116	7.75 + 15	28.6395	23.8389	8.0315
-2.4	2.08796	2.08899	16.8522	18.9401	59.9259	-.5165	9.82 + 15	24.6607	20.4418	8.0205
-2.2	2.06793	2.06885	16.4997	18.5676	58.6166	-.3207	1.24 + 16	21.5911	17.7925	8.0185
-2.0	2.05053	2.05134	16.2011	18.2516	57.3698	-.1244	1.58 + 16	19.3381	15.8243	8.0210
-1.8	2.03452	2.03522	15.9374	17.9719	56.1055	.0722	1.99 + 16	17.8580	14.5065	8.0217
-1.6	2.01849	2.01909	15.6885	17.7070	54.9834	.2688	2.51 + 16	17.1647	13.8494	8.0131
-1.4	2.00081	2.00130	15.4322	17.4330	53.8015	.4650	3.17 + 16	17.3223	13.9028	7.9870
-1.2	1.97948	1.97983	15.1426	17.1221	52.5952	.6603	3.99 + 16	18.4357	14.7390	7.9377
-1.0	1.95218	1.95237	14.7906	16.7428	51.3376	.8543	5.01 + 16	20.5976	16.4067	7.8634
-.8	1.91650	1.91648	14.3460	16.2625	50.0018	1.0463	6.26 + 16	23.7932	18.8518	7.7656
-.6	1.87042	1.87011	13.7838	15.6543	48.5673	1.2357	7.80 + 16	27.7743	21.8277	7.6464
-.4	1.81310	1.81237	13.0927	14.9058	47.0276	1.4222	9.66 + 16	31.9827	24.8683	7.5072
-.2	1.74544	1.74414	12.2821	14.0275	45.3972	1.6057	1.19 + 17	35.6334	27.3928	7.3503
-.0	1.67024	1.66811	11.3829	13.0531	43.7113	1.7866	1.46 + 17	37.9783	28.9133	7.1802
.2	1.59152	1.58820	10.4404	12.0319	42.0177	1.9656	1.78 + 17	38.5956	29.2077	7.0037
.4	1.51350	1.50853	9.5027	11.0163	40.3651	2.1438	2.17 + 17	37.5083	28.3484	6.8295
.6	1.44028	1.43263	8.6105	10.0508	38.7930	2.3222	2.64 + 17	35.0854	26.6047	6.6662
.8	1.37447	1.36297	7.7926	9.1670	37.3273	2.5019	3.22 + 17	31.8393	24.3122	6.5218
1.0	1.31821	1.30088	7.0644	8.3826	35.9795	2.6838	3.95 + 17	28.2515	21.7767	6.4037
1.2	1.27200	1.24680	6.4311	7.7041	34.7500	2.8686	4.87 + 17	24.6832	19.2292	6.3194
1.4	1.24027	1.20049	5.8899	7.1302	33.6307	3.0573	6.06 + 17	21.3594	16.8201	6.2779
1.6	1.22206	1.16131	5.4337	6.6558	32.6081	3.2509	7.64 + 17	18.3922	14.6318	6.2914
1.8	1.22165	1.12842	5.0532	6.2748	31.6657	3.4507	9.81 + 17	15.8165	12.6971	6.3782
2.0	1.24465	1.10089	4.7387	5.9834	30.7843	3.6588	1.29 + 18	13.6213	11.0172	6.5650

† N(E) is the number of electrons per cm<sup>3</sup>, expressed in the form a + b, meaning a × 10<sup>b</sup>.

TABLE 4h-29. THERMODYNAMIC PROPERTIES OF NITROGEN (Continued)  
 $T = 12,000 \text{ K}$ 

$\log \rho/\rho_0$	$Z$	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	3.89384	3.89756	42.3391	46.2329	107.6566	-2.7667	5.10 + 14	35.2358	27.8584	12.2802
-4.8	3.84199	3.84648	41.5624	45.4044	105.0980	-2.5725	7.86 + 14	46.0096	36.8252	12.0582
-4.6	3.77010	3.77544	40.4828	44.2529	102.2648	-2.3807	1.20 + 15	59.4348	47.7151	11.8445
-4.4	3.67524	3.68143	39.0550	42.7303	99.1219	-2.1918	1.80 + 15	74.5153	59.5572	11.6258
-4.2	3.55714	3.56413	37.2743	40.8314	95.6750	-2.0059	2.65 + 15	89.2729	70.7073	11.3921
-4.0	3.41909	3.42676	35.1897	38.6087	91.9834	-1.8231	3.83 + 15	101.2202	79.3388	11.1399
-3.8	3.26763	3.27579	32.8994	36.1671	88.1532	-1.6428	5.43 + 15	108.2871	84.1379	10.8726
-3.6	3.11094	3.11939	30.5275	33.6385	84.3126	-1.4642	7.56 + 15	109.6088	84.7330	10.5988
-3.4	2.95702	2.96554	28.1950	31.1520	80.5832	-1.2862	1.03 + 16	105.6704	81.6338	10.3291
-3.2	2.81223	2.82063	25.9985	28.8107	77.0588	-1.1080	1.39 + 16	97.8534	75.8521	10.0732
-3.0	2.68073	2.68887	24.0019	26.6827	73.7980	-.9288	1.85 + 16	87.8025	68.5000	9.8388
2.8	2.56464	2.57240	22.2375	24.8021	70.8265	.7480	2.44 + 16	76.0592	60.5225	9.6308
-2.6	2.46437	2.47168	20.7124	23.1767	68.1441	-.5653	3.19 + 16	66.3548	52.6473	9.4515
-2.4	2.37925	2.38606	19.4166	21.7959	65.7336	-.3806	4.13 + 16	56.6156	45.2877	9.3011
-2.2	2.30792	2.31422	18.3302	20.6381	63.5684	-.1938	5.34 + 16	48.0408	38.6928	9.1785
-2.0	2.24869	2.25448	17.4280	19.6767	61.6175	-.0051	6.86 + 16	40.7144	32.9578	9.0818
-1.8	2.19980	2.20508	16.6837	18.8835	59.8493	.1853	8.80 + 16	34.5958	28.0871	9.0082
-1.6	2.15947	2.16426	16.0714	18.2308	58.2335	.3773	1.13 + 17	29.5848	24.0357	8.9549
-1.4	2.12603	2.13035	15.5665	17.6925	56.7421	.5705	1.44 + 17	25.5652	20.7392	8.9182
-1.2	2.09787	2.10172	15.1463	17.2442	55.3496	.7647	1.83 + 17	22.4324	18.1344	8.8941
-1.0	2.07338	2.07676	14.7890	16.8624	54.0319	.9596	2.33 + 17	20.1095	16.1739	8.8773
-.8	2.05092	2.05379	14.4730	16.5240	52.7664	1.1549	2.97 + 17	18.5591	14.8355	8.8609
-.6	2.02865	2.03095	14.1759	16.2045	51.5298	1.3502	3.77 + 17	17.7873	14.1263	8.8367
-.4	2.00448	2.00608	13.8720	15.8774	50.2081	1.5450	4.80 + 17	17.8368	14.0758	8.7959
-.2	1.97601	1.97672	13.5370	15.5130	49.0454	1.7387	6.08 + 17	18.7592	14.7108	8.7316
-.0	1.94072	1.94022	13.1398	15.0805	47.7461	1.9309	7.70 + 17	20.5531	16.0044	8.6409
.2	1.89640	1.89419	12.6561	14.5525	46.3784	2.1209	9.73 + 17	23.0720	17.8091	8.5242
.4	1.84185	1.83722	12.0703	13.9122	44.9315	2.3082	1.23 + 18	25.9489	19.8184	8.3842
.6	1.77763	1.76950	11.3836	13.1612	43.4110	2.4928	1.54 + 18	28.6180	21.6135	8.2255
.8	1.70635	1.69318	10.6160	12.3223	41.8410	2.6750	1.94 + 18	30.4802	22.7989	8.0556
1.0	1.63231	1.61182	9.8022	11.4345	40.2584	2.8558	2.43 + 18	31.1283	23.1454	7.8856
1.2	1.56070	1.52949	8.9821	10.5428	38.7033	3.0363	3.06 + 18	30.4801	22.6414	7.7302
1.4	1.49687	1.44987	8.1916	9.6885	37.2091	3.2181	3.87 + 18	28.7446	21.4420	7.6069
1.6	1.44616	1.37563	7.4572	8.9034	35.7977	3.4032	4.96 + 18	26.2816	19.7759	7.5362
1.8	1.41417	1.30831	6.7946	8.2088	34.4773	3.5935	6.48 + 18	23.4606	17.8661	7.5435
2.0	1.40779	1.24840	6.2102	7.6180	33.2443	3.7015	8.70 + 18	20.5782	15.8004	7.6608

$\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-29. THERMODYNAMIC PROPERTIES OF NITROGEN (Continued)  
 $T = 14,000$  K

$\log \rho/\rho_0$	$Z$	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	3.98442	3.98759	38.4405	42.4250	110.0090	-2.6897	5.34 + 14	13.4990	9.1410	14.6494
-4.8	3.97617	3.98013	38.3386	42.3148	108.0739	-2.4906	8.43 + 14	14.7994	10.2533	14.4552
-4.6	3.96375	3.96869	38.1846	42.1483	106.0914	-2.2920	1.33 + 15	16.8835	12.0340	14.2098
-4.4	3.94507	3.95121	37.9511	41.8962	104.0366	-2.0940	2.09 + 15	20.0705	14.7420	13.9361
-4.2	3.91726	3.92484	37.6007	41.5180	101.8755	-1.8971	3.26 + 15	24.7569	18.6854	13.6577
-4.0	3.87667	3.88592	37.0854	40.9621	99.5650	-1.7016	5.07 + 15	31.3375	24.1420	13.3993
-3.8	3.81914	3.83028	36.3503	40.1695	97.0572	-1.5081	7.79 + 15	40.0270	31.2001	13.1364
-3.6	3.74084	3.75399	35.3444	39.0852	94.3097	-1.3171	1.18 + 16	50.5831	39.5436	12.8883
-3.4	3.63954	3.65471	34.0372	37.6767	91.3023	-1.1291	1.77 + 16	62.0583	48.3114	12.6342
-3.2	3.51598	3.53301	32.4367	35.9526	88.0533	-.9441	2.60 + 16	72.8262	56.2191	12.3656
-3.0	3.37439	3.39296	30.5967	33.9711	84.6263	-.7619	3.74 + 16	81.0447	61.9814	12.0803
-2.8	3.22182	3.24149	28.6084	31.8302	81.1189	-.5820	5.29 + 16	85.3575	64.7957	11.7834
-2.6	3.00040	3.08667	26.5777	29.6441	77.6405	-.4035	7.33 + 16	85.3746	64.5639	11.4842
-2.4	2.91560	2.93601	24.6030	27.5186	74.2887	-.2254	1.00 + 17	81.6518	61.7724	11.1936
-2.2	2.77512	2.79524	22.7593	25.5344	71.1352	-.0468	1.35 + 17	75.2978	57.1972	10.9213
-2.0	2.64848	2.66798	21.0937	23.7422	68.2214	.1329	1.80 + 17	67.5224	51.6344	10.6744
-1.8	2.53725	2.55588	19.6278	22.1651	65.5621	.3143	2.37 + 17	59.3377	45.7417	10.4573
-1.6	2.44152	2.45911	18.3638	20.8053	63.1523	.4976	3.10 + 17	51.4482	39.9878	10.2715
-1.4	2.36039	2.37685	17.2907	19.6511	60.9741	.6829	4.04 + 17	44.2666	34.6643	10.1168
-1.2	2.29238	2.30766	16.3900	18.6824	59.0026	.8702	5.24 + 17	37.9846	29.9255	9.9914
-1.0	2.23575	2.24982	15.6397	17.8754	57.2100	1.0593	6.78 + 17	32.6513	25.8312	9.8926
-.8	2.18865	2.20149	15.0165	17.2051	55.5684	1.2501	8.74 + 17	28.2368	22.3849	9.8170
-.6	2.14923	2.16082	14.4973	16.6466	54.0507	1.4422	1.13 + 18	24.6792	19.5624	9.7604
-.4	2.11566	2.12591	14.0598	16.1755	52.6315	1.6353	1.45 + 18	21.9149	17.3337	9.7177
-.2	2.08004	2.09480	13.6817	15.7677	51.2860	1.8292	1.87 + 18	19.8990	15.6769	9.6828
-.0	2.05840	2.06537	13.3400	15.3984	49.9901	2.0234	2.40 + 18	18.6156	14.5871	9.6481
.2	2.03056	2.03525	13.0108	15.0413	48.7193	2.2175	3.10 + 18	18.0776	14.0754	9.6049
.4	2.00012	2.00174	12.6679	14.6680	47.4481	2.4110	4.00 + 18	18.3090	14.1534	9.5451
.6	1.96466	1.96196	12.2842	14.2489	46.1514	2.6032	5.16 + 18	19.2999	14.7975	9.4634
.8	1.92215	1.91324	11.8352	13.7573	44.8070	2.7937	6.68 + 18	20.9371	15.9001	9.3593
1.0	1.87168	1.85378	11.3038	13.1755	43.4018	2.9821	8.66 + 18	22.9394	17.2342	9.2371
1.2	1.81434	1.78337	10.6872	12.5016	41.9363	3.1686	1.13 + 19	24.8634	18.4806	9.1067
1.4	1.75368	1.70374	9.9992	11.7329	40.4207	3.3539	1.48 + 19	26.9200	19.9242	8.9836
1.6	1.69564	1.61818	9.2670	10.9626	38.9005	3.5392	1.96 + 19	26.6528	19.5647	8.8907
1.8	1.64812	1.53063	8.5239	10.1720	37.3881	3.7269	2.67 + 19	26.0586	19.1666	8.8586
2.0	1.62076	1.44479	7.8019	9.4227	35.9144	3.9196	3.76 + 19	24.5826	18.2331	8.9257

$^\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-29. THERMODYNAMIC PROPERTIES OF NITROGEN (Continued)  
 $T = 16,000$  K

$\log p/p_0$	Z	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	4.00486	4.00751	34.7983	38.8031	111.2459	-2.6295	5.39 + 14	16.8199	12.2744	15.1260
-4.8	3.99908	4.00239	34.6959	38.6950	109.3006	-2.4301	8.53 + 14	14.9838	10.5851	15.3666
-4.6	3.99363	3.99778	34.6139	38.6075	107.3781	-2.2307	1.35 + 15	14.0217	9.6837	15.5310
-4.4	3.98750	3.99270	34.5354	38.5229	105.4619	-2.0314	2.13 + 15	13.7384	9.3885	15.5969
-4.2	3.97961	3.98612	34.4450	38.4346	103.5360	-1.8323	3.37 + 15	14.0680	0.6320	15.5578
-4.0	3.96862	3.97675	34.3252	38.2938	101.5868	-1.6335	5.31 + 15	15.0567	10.4430	15.4208
-3.8	3.95269	3.96282	34.1541	38.1068	99.5916	-1.4352	8.36 + 15	16.8539	11.9360	15.2059
-3.6	3.92940	3.94194	33.9031	37.8325	97.5253	-1.2378	1.31 + 16	19.6999	14.2950	14.9418
-3.4	3.89553	3.91094	33.5348	37.4303	95.3547	-1.0415	2.04 + 16	23.8884	17.7333	14.6574
-3.2	3.84725	3.86598	33.0044	36.8517	93.0409	-.8470	3.16 + 16	29.6715	22.4049	14.3724
-3.0	3.78057	3.80295	32.2649	36.0454	90.5443	-.6545	4.84 + 16	37.0841	28.2583	14.0925
-2.8	3.69234	3.71857	31.2783	34.9707	87.8362	-.4648	7.32 + 16	45.7253	34.8830	13.8123
-2.6	3.58163	3.61160	30.0314	33.6131	84.9136	-.2780	1.09 + 17	54.6326	41.4715	13.5231
-2.4	3.45067	3.48402	28.5476	31.9983	81.8099	-.0942	1.59 + 17	62.4355	47.0102	13.2193
-2.2	3.30494	3.34100	26.8877	30.1926	78.5940	.0871	2.27 + 17	67.8093	50.6395	12.9019
-2.0	3.15193	3.18987	25.1366	28.2885	75.3562	.2665	3.20 + 17	69.9751	51.9549	12.5780
-1.8	2.99944	3.03837	23.3840	26.3835	72.1874	.4440	4.12 + 17	68.9216	51.0660	12.2680
-1.6	2.85408	2.89317	21.7068	24.5608	69.1628	.6234	6.03 + 17	65.2614	48.4401	11.9526
-1.4	2.72049	2.75903	20.1596	22.8801	66.3326	.8025	8.12 + 17	59.8968	44.6797	11.6707
-1.2	2.60128	2.63871	18.7740	21.3753	63.7222	.9831	1.08 + 18	53.7136	40.3514	11.4183
-1.0	2.49733	2.53323	17.5615	20.0588	61.3364	1.1654	1.43 + 18	47.4093	35.9009	11.1985
-.8	2.40828	2.44237	16.5193	18.9276	59.1652	1.3496	1.89 + 18	41.4486	31.6346	11.0119
-.6	2.33296	2.36503	15.6350	17.9680	57.1898	1.5358	2.48 + 18	36.0932	27.7384	10.8573
-.4	2.26977	2.29967	14.8912	17.1610	55.3866	1.7239	3.24 + 18	31.4597	24.3085	10.7320
-.2	2.21689	2.24445	14.2677	16.4846	53.7303	1.9136	4.23 + 18	27.5755	21.3828	10.6326
-.0	2.17243	2.19740	13.7434	15.9158	52.1957	2.1048	5.53 + 18	24.4242	18.9677	10.5546
.2	2.13446	2.15643	13.2968	15.4313	50.7577	2.2972	7.23 + 18	21.9773	17.0581	10.4928
.4	2.10100	2.11926	12.9060	15.0070	49.3918	2.4903	9.48 + 18	20.2155	15.6511	10.4412
.6	2.07000	2.08338	12.5480	14.6180	48.0734	2.6839	1.25 + 19	19.1374	14.7523	10.3932
.8	2.03934	2.04597	12.1981	14.2375	46.7773	2.8774	1.65 + 19	18.7556	14.3712	10.3420
1.0	2.00698	2.00390	11.8307	13.8377	45.4781	3.0704	2.19 + 19	19.0712	14.5017	10.2831
1.2	1.97130	1.95408	11.4206	13.3919	44.1519	3.2626	2.95 + 19	20.0236	15.0864	10.2166
1.4	1.93189	1.89399	10.9479	12.8798	42.7802	3.4539	4.01 + 19	21.4329	15.9824	10.1495
1.6	1.89045	1.82254	10.4033	12.2937	41.3555	3.6445	5.58 + 19	22.9770	16.9630	10.0976
1.8	1.85158	1.74076	9.7937	11.6453	39.8845	3.8354	8.03 + 19	24.2625	17.7828	10.0857
2.0	1.82286	1.65216	9.1447	10.9675	38.3899	4.0286	1.23 + 20	25.0006	18.2986	10.1454

$^\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-30. THERMODYNAMIC PROPERTIES OF ARGON

 $T = 4000$  K

$\log \rho/\rho_0$	Z	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	1.00000	1.00000	1.5000	2.5000	33.9295	-3.8339	1.54 + 08	2.5007	1.5006	3.8258
-4.8	1.00000	1.00000	1.5000	2.5000	33.4690	-3.6339	1.94 + 08	2.5005	1.5005	3.8259
-4.6	1.00000	1.00000	1.5000	2.5000	33.0085	-3.4339	2.44 + 08	2.5004	1.5004	3.8259
-4.4	1.00000	1.00000	1.5000	2.5000	32.5480	-3.2339	3.07 + 08	2.5003	1.5003	3.8260
-4.2	1.00000	1.00000	1.5000	2.5000	32.0875	-3.0339	3.87 + 08	2.5003	1.5003	3.8260
-4.0	1.00000	1.00000	1.5000	2.5000	31.6269	-2.8339	4.87 + 08	2.5002	1.5002	3.8260
-3.8	1.00000	1.00000	1.5000	2.5000	31.1664	-2.6339	6.13 + 08	2.5002	1.5002	3.8261
-3.6	1.00000	1.00000	1.5000	2.5000	30.7059	-2.4339	7.72 + 08	2.5001	1.5001	3.8261
-3.4	1.00000	1.00000	1.5000	2.5000	30.2454	-2.2339	9.72 + 08	2.5001	1.5001	3.8261
-3.2	1.00000	1.00000	1.5000	2.5000	29.7849	-2.0339	1.22 + 09	2.5001	1.5001	3.8261
-3.0	1.00000	1.00000	1.5000	2.5000	29.3244	-1.8339	1.54 + 09	2.5001	1.5001	3.8261
-2.8	1.00000	1.00000	1.5000	2.5000	28.8638	-1.6339	1.94 + 09	2.5001	1.5001	3.8261
-2.6	1.00000	1.00000	1.5000	2.5000	28.4033	-1.4339	2.44 + 09	2.5000	1.5000	3.8261
-2.4	1.00000	1.00000	1.5000	2.5000	27.9428	-1.2339	3.07 + 09	2.5000	1.5000	3.8261
-2.2	1.00001	1.00000	1.5000	2.5000	27.4823	-1.0339	3.87 + 09	2.5000	1.5000	3.8261
-2.0	1.00001	1.00000	1.5000	2.5000	27.0218	-.8339	4.87 + 09	2.5000	1.5000	3.8262
-1.8	1.00002	1.00000	1.5000	2.5000	26.5612	-.6339	6.13 + 09	2.5000	1.5000	3.8262
-1.6	1.00003	1.00000	1.5000	2.5000	26.1007	-.4339	7.72 + 09	2.5000	1.5000	3.8262
-1.4	1.00005	1.00000	1.5000	2.5000	25.6402	-.2339	9.72 + 09	2.5000	1.5000	3.8263
-1.2	1.00007	1.00000	1.5000	2.5001	25.1796	-.0339	1.22 + 10	2.5000	1.5000	3.8264
-1.0	1.00012	1.00000	1.5000	2.5001	24.7191	.1661	1.54 + 10	2.5000	1.5000	3.8200
-.8	1.00019	1.00000	1.5000	2.5002	24.2585	.3661	1.94 + 10	2.5000	1.5000	3.8268
-.6	1.00030	1.00000	1.5000	2.5003	23.7979	.5662	2.45 + 10	2.5000	1.5001	3.8272
-.4	1.00047	1.00000	1.5000	2.5005	23.3372	.7663	3.08 + 10	2.5001	1.5001	3.8278
-.2	1.00075	1.00000	1.5000	2.5008	22.8764	.9664	3.80 + 10	2.5001	1.5002	3.8288
-.0	1.00118	1.00000	1.5001	2.5012	22.4155	1.1666	4.90 + 10	2.5001	1.5002	3.8304
.2	1.00187	1.00000	1.5001	2.5020	21.9543	1.3669	6.20 + 10	2.5002	1.5004	3.8330
.4	1.00297	1.00000	1.5002	2.5031	21.4927	1.5673	7.85 + 10	2.5003	1.5006	3.8369
.6	1.00470	1.00000	1.5002	2.5049	21.0306	1.7681	9.98 + 10	2.5005	1.5009	3.8433
.8	1.00745	1.00000	1.5004	2.5078	20.5675	1.9693	1.28 + 11	2.5008	1.5015	3.8532
1.0	1.01181	1.00000	1.5006	2.5124	20.1028	2.1712	1.65 + 11	2.5013	1.5024	3.8690
1.2	1.01872	1.00000	1.5010	2.5197	19.6357	2.3741	2.15 + 11	2.5022	1.5038	3.8940
1.4	1.02968	1.00000	1.5015	2.5312	19.1648	2.5788	2.88 + 11	2.5039	1.5060	3.9303
1.6	1.04703	1.00000	1.5024	2.5494	18.6878	2.7860	4.00 + 11	2.5069	1.5095	3.9950
1.8	1.07454	1.00000	1.5038	2.5783	18.2012	2.9973	5.88 + 11	2.5127	1.5150	4.0915
2.0	1.11814	1.00000	1.5060	2.6242	17.6993	3.2146	9.46 + 11	2.5242	1.5237	4.2413

$\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .



TABLE 4h-30. THERMODYNAMIC PROPERTIES OF ARGON (Continued)

 $T = 6000$  K

$\log \rho/\rho_0$	$Z$	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$\alpha/\alpha_0$
-5.0	1.00162	1.00162	1.5519	2.5535	34.5928	-3.6572	4.35 + 11	3.3885	2.3335	4.3758
-4.8	1.00128	1.00128	1.5412	2.5425	34.1210	-3.4573	5.47 + 11	3.2059	2.1623	4.4211
-4.6	1.00102	1.00102	1.5327	2.5338	33.6515	-3.2574	6.89 + 11	3.0608	2.0262	4.4623
-4.4	1.00081	1.00081	1.5260	2.5268	33.1838	-3.0575	8.68 + 11	2.9455	1.9181	4.4990
-4.2	1.00064	1.00064	1.5207	2.5213	32.7176	-2.8576	1.09 + 12	2.8539	1.8322	4.5309
-4.0	1.00051	1.00051	1.5164	2.5169	32.2526	-2.6576	1.38 + 12	2.7812	1.7639	4.5584
-3.8	1.00041	1.00041	1.5130	2.5134	31.7885	-2.4577	1.73 + 12	2.7234	1.7097	4.5817
-3.6	1.00032	1.00032	1.5104	2.5107	31.3251	-2.2577	2.18 + 12	2.6774	1.6666	4.6011
-3.4	1.00026	1.00026	1.5082	2.5085	30.8623	-2.0577	2.74 + 12	2.6410	1.6323	4.6173
-3.2	1.00020	1.00020	1.5065	2.5067	30.4000	-1.8578	3.46 + 12	2.6120	1.6051	4.6306
-3.0	1.00016	1.00016	1.5052	2.5054	29.9381	-1.6578	4.35 + 12	2.5890	1.5835	4.6414
-2.8	1.00013	1.00013	1.5041	2.5043	29.4764	-1.4578	5.48 + 12	2.5707	1.5663	4.6502
-2.6	1.00010	1.00010	1.5033	2.5034	29.0150	-1.2578	6.90 + 12	2.5561	1.5527	4.6574
-2.4	1.00009	1.00008	1.5026	2.5027	28.5538	-1.0578	8.69 + 12	2.5446	1.5419	4.6631
-2.2	1.00007	1.00006	1.5021	2.5021	28.0927	-.8578	1.09 + 13	2.5354	1.5333	4.6678
-2.0	1.00006	1.00005	1.5016	2.5017	27.6317	-.6578	1.38 + 13	2.5282	1.5264	4.6715
-1.8	1.00006	1.00004	1.5013	2.5014	27.1708	-.4578	1.73 + 13	2.5224	1.5210	4.6745
-1.6	1.00006	1.00003	1.5010	2.5011	26.7100	-.2578	2.18 + 13	2.5178	1.5167	4.6769
-1.4	1.00007	1.00003	1.5008	2.5009	26.2492	-.0578	2.75 + 13	2.5141	1.5133	4.6789
-1.2	1.00009	1.00002	1.5007	2.5008	25.7885	.1422	3.46 + 13	2.5112	1.5105	4.6805
-1.0	1.00013	1.00002	1.5005	2.5007	25.3278	.3422	4.36 + 13	2.5089	1.5084	4.6819
-.8	1.00019	1.00001	1.5004	2.5006	24.8671	.5422	5.49 + 13	2.5071	1.5067	4.6831
-.6	1.00030	1.00001	1.5004	2.5007	24.4064	.7423	6.92 + 13	2.5056	1.5053	4.6843
-.4	1.00046	1.00001	1.5003	2.5008	23.9457	.9423	8.72 + 13	2.5045	1.5043	4.6857
-.2	1.00073	1.00001	1.5003	2.5010	23.4849	1.1425	1.10 + 14	2.5036	1.5035	4.6873
0	1.00115	1.00001	1.5003	2.5014	23.0239	1.3426	1.39 + 14	2.5028	1.5029	4.6895
.2	1.00182	1.00000	1.5003	2.5021	22.5628	1.5429	1.75 + 14	2.5022	1.5025	4.6928
.4	1.00288	1.00000	1.5004	2.5033	22.1013	1.7434	2.21 + 14	2.5018	1.5023	4.6976
.6	1.00456	1.00000	1.5005	2.5051	21.6392	1.9441	2.81 + 14	2.5014	1.5022	4.7052
.8	1.00722	1.00000	1.5008	2.5080	21.1763	2.1453	3.57 + 14	2.5012	1.5025	4.7169
1.0	1.01145	1.00000	1.5012	2.5127	20.7120	2.3471	4.57 + 14	2.5010	1.5031	4.7354
1.2	1.01814	1.00000	1.5010	2.5200	20.2454	2.5500	5.01 + 14	2.5010	1.5043	4.7645
1.4	1.02875	1.00000	1.5030	2.5317	19.7754	2.7545	7.75 + 14	2.5013	1.5062	4.8102
1.6	1.04557	1.00000	1.5047	2.5502	19.2998	2.9615	1.04 + 15	2.5024	1.5094	4.8820
1.8	1.07222	1.00000	1.5074	2.5796	18.8153	3.1724	1.45 + 15	2.5054	1.5145	4.9943
2.0	1.11446	1.00000	1.5117	2.6262	18.3169	3.3892	2.15 + 15	2.5124	1.5228	5.1685

$\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-30. THERMODYNAMIC PROPERTIES OF ARGON (Continued)

 $T = 8000 \text{ K}$ 

$\log \rho/\rho_0$	$Z$	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	1.08764	1.08771	3.6428	4.7334	37.2914	-3.4964	2.36 + 13	30.8686	26.6115	4.6163
-4.8	1.07028	1.07034	3.2185	4.2887	36.3703	-3.3034	3.00 + 13	25.3133	21.8364	4.5941
-4.6	1.05625	1.05630	2.8755	3.9317	35.5378	-3.1091	3.80 + 13	20.7930	17.9039	4.5817
-4.4	1.04495	1.04500	2.5993	3.6443	34.7779	-2.9138	4.81 + 13	17.1368	14.6903	4.5786
-4.2	1.03588	1.03592	2.3775	3.4134	34.0771	-2.7176	6.09 + 13	14.1926	12.0800	4.5843
-4.0	1.02861	1.02865	2.1998	3.2284	33.4241	-2.5207	7.70 + 13	11.8293	9.9698	4.5984
-3.8	1.02279	1.02283	2.0577	3.0805	32.8097	-2.3231	9.72 + 13	9.9369	8.2701	4.6207
-3.6	1.01815	1.01818	1.9442	2.9623	32.2263	-2.1251	1.23 + 14	8.4243	6.9050	4.6506
-3.4	1.01445	1.01447	1.8536	2.8680	31.6677	-1.9267	1.55 + 14	7.2169	5.8110	4.6878
-3.2	1.01149	1.01152	1.7814	2.7929	31.1290	-1.7280	1.95 + 14	6.2541	4.9360	4.7315
-3.0	1.00914	1.00916	1.7239	2.7330	30.6063	-1.5290	2.46 + 14	5.4870	4.2370	4.7806
-2.8	1.00727	1.00729	1.6781	2.6853	30.0962	-1.3298	3.10 + 14	4.8761	3.6792	4.8339
-2.6	1.00578	1.00580	1.6418	2.6474	29.5962	-1.1304	3.91 + 14	4.3899	3.2346	4.8898
-2.4	1.00460	1.00461	1.6126	2.6172	29.1044	-.9309	4.93 + 14	4.0031	2.8804	4.9468
-2.2	1.00366	1.00367	1.5896	2.5932	28.6189	-.7313	6.22 + 14	3.6953	2.5983	5.0030
-2.0	1.00291	1.00292	1.5712	2.5741	28.1385	-.5316	7.84 + 14	3.4506	2.3738	5.0571
-1.8	1.00232	1.00232	1.5566	2.5590	27.6622	-.3319	9.88 + 14	3.2560	2.1951	5.1077
-1.6	1.00186	1.00184	1.5450	2.5469	27.1892	-.1321	1.24 + 15	3.1013	2.0530	5.1539
-1.4	1.00150	1.00147	1.5358	2.5373	26.7187	.0677	1.57 + 15	2.9783	1.9400	5.1953
-1.2	1.00123	1.00117	1.5285	2.5297	26.2502	.2676	1.98 + 15	2.8805	1.8501	5.2317
-1.0	1.00103	1.00093	1.5227	2.5237	25.7833	.4675	2.40 + 15	2.8028	1.7786	5.2632
-.8	1.00091	1.00074	1.5181	2.5190	25.3177	.6675	3.15 + 15	2.7410	1.7218	5.2901
-.6	1.00086	1.00059	1.5144	2.5153	24.8532	.8675	3.97 + 15	2.6918	1.6766	5.3130
-.4	1.00090	1.00047	1.5115	2.5124	24.3893	1.0675	5.01 + 15	2.6528	1.6408	5.3324
-.2	1.00107	1.00037	1.5092	2.5103	23.9261	1.2675	6.32 + 15	2.6217	1.6123	5.3489
-.0	1.00140	1.00030	1.5074	2.5088	23.4632	1.4677	7.99 + 15	2.5970	1.5897	5.3635
.2	1.00199	1.00024	1.5060	2.5080	23.0005	1.6679	1.01 + 16	2.5774	1.5718	5.3769
.4	1.00296	1.00019	1.5050	2.5080	22.5379	1.8684	1.28 + 16	2.5618	1.5577	5.3902
.6	1.00455	1.00015	1.5043	2.5088	22.0749	2.0691	1.62 + 16	2.5494	1.5467	5.4049
.8	1.00710	1.00012	1.5039	2.5110	21.6114	2.2702	2.07 + 16	2.5395	1.5382	5.4230
1.0	1.01116	1.00010	1.5038	2.5150	21.1467	2.4719	2.65 + 16	2.5316	1.5319	5.4475
1.2	1.01762	1.00008	1.5042	2.5218	20.6800	2.6747	3.41 + 16	2.5254	1.5276	5.4827
1.4	1.02786	1.00007	1.5052	2.5330	20.2102	2.8790	4.45 + 16	2.5206	1.5253	5.5357
1.6	1.04411	1.00006	1.5070	2.5511	19.7352	3.0858	5.92 + 16	2.5173	1.5253	5.6168
1.8	1.06988	1.00005	1.5101	2.5800	19.2520	3.2964	8.11 + 16	2.5162	1.5279	5.7420
2.0	1.11073	1.00004	1.5153	2.6260	18.7558	3.5127	1.16 + 17	2.5191	1.5344	5.9353

 $^\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-30. THERMODYNAMIC PROPERTIES OF ARGON (Continued)

 $T = 10,000 \text{ K}$ 

$\log \rho/\rho_0$	$Z$	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	1.64223	1.64320	14.2637	15.9059	49.7398	-3.2206	1.73 + 14	86.0704	69.1039	6.3474
-4.8	1.56361	1.56461	12.7038	14.2674	47.4418	-3.0419	2.40 + 14	87.5084	69.8199	6.1903
-4.6	1.48602	1.48703	11.1639	12.6499	45.1999	-2.8640	3.29 + 14	84.4647	67.2871	6.0341
-4.4	1.41277	1.41377	9.7099	11.1227	43.0787	-2.6859	4.43 + 14	78.0709	62.3681	5.8848
-4.2	1.34009	1.34705	8.3650	9.7220	41.1109	-2.5069	5.88 + 14	69.7159	56.0343	5.7472
-4.0	1.28712	1.28804	7.2148	8.5019	39.3427	-2.3264	7.74 + 14	60.6334	49.1289	5.6246
-3.8	1.23616	1.23701	6.2022	7.4384	37.7495	-2.1439	1.01 + 15	51.7164	42.2718	5.5185
-3.6	1.19289	1.19368	5.3424	6.5353	36.3307	-1.9594	1.31 + 15	43.5056	35.8580	5.4293
-3.4	1.15667	1.15740	4.6225	5.7792	35.0701	-1.7728	1.68 + 15	36.2615	30.0997	5.3567
-3.2	1.12668	1.12736	4.0263	5.1530	33.9485	-1.5842	2.16 + 15	30.0553	25.0792	5.2998
-3.0	1.10208	1.10269	3.5369	4.6390	32.9461	-1.3938	2.76 + 15	24.8464	20.7949	5.2575
-2.8	1.08202	1.08258	3.1379	4.2199	32.0443	-1.2018	3.52 + 15	20.5376	17.1969	5.2287
-2.6	1.06575	1.06626	2.8142	3.8499	31.2202	-1.0083	4.47 + 15	17.0100	14.2119	5.2125
-2.4	1.05262	1.05308	2.5527	3.6053	30.4771	-0.8137	5.68 + 15	14.1436	11.7583	5.2078
-2.2	1.04206	1.04247	2.3422	3.3843	29.7844	-0.6181	7.20 + 15	11.8268	9.7558	5.2141
-2.0	1.03358	1.03394	2.1732	3.2068	29.1375	-0.4217	9.12 + 15	9.9616	8.1305	5.2306
-1.8	1.02680	1.02711	2.0378	3.0645	28.5277	-0.2245	1.15 + 16	8.4644	6.8169	5.2567
-1.6	1.02137	1.02165	1.9294	2.9507	27.9477	-0.0268	1.46 + 16	7.2651	5.7588	5.2914
-1.4	1.01705	1.01728	1.8427	2.8598	27.3918	.1713	1.85 + 16	6.3058	4.9088	5.3338
-1.2	1.01361	1.01379	1.7736	2.7872	26.8551	.3699	2.34 + 16	5.5395	4.2272	5.3826
-1.0	1.01089	1.01101	1.7184	2.7293	26.3338	.5687	2.96 + 16	4.9278	3.6815	5.4364
-.8	1.00875	1.00879	1.6744	2.6832	25.8248	.7678	3.74 + 16	4.4399	3.2452	5.4935
-.6	1.00710	1.00702	1.6394	2.6465	25.3256	.9671	4.74 + 16	4.0508	2.8967	5.5522
-.4	1.00586	1.00560	1.6114	2.6173	24.8342	1.1665	6.00 + 16	3.7406	2.6185	5.6106
-.2	1.00500	1.00448	1.5892	2.5942	24.3489	1.3662	7.60 + 16	3.4934	2.3905	5.6675
-.0	1.00451	1.00359	1.5715	2.5760	23.8686	1.5660	9.64 + 16	3.2965	2.2196	5.7216
.2	1.00444	1.00287	1.5575	2.5619	23.3920	1.7659	1.22 + 17	3.1396	2.0786	5.7726
.4	1.00487	1.00231	1.5464	2.5513	22.9183	1.9661	1.56 + 17	3.0146	1.9665	5.8206
.6	1.00600	1.00185	1.5377	2.5437	22.4466	2.1666	1.98 + 17	2.9151	1.8774	5.8664
.8	1.00814	1.00150	1.5310	2.5391	21.9761	2.3675	2.54 + 17	2.8360	1.8070	5.9120
1.0	1.01181	1.00121	1.5260	2.5378	21.5061	2.5691	3.26 + 17	2.7732	1.7516	5.9605
1.2	1.01786	1.00099	1.5225	2.5403	21.0353	2.7717	4.23 + 17	2.7234	1.7087	6.0168
1.4	1.02762	1.00082	1.5205	2.5481	20.5625	2.9758	5.54 + 17	2.6844	1.6762	6.0885
1.6	1.04323	1.00069	1.5202	2.5634	20.0857	3.1824	7.39 + 17	2.6545	1.6531	6.1869
1.8	1.06809	1.00060	1.5219	2.5900	19.6017	3.3926	1.01 + 18	2.6330	1.6389	6.3291
2.0	1.10757	1.00054	1.5264	2.6340	19.1059	3.6084	1.45 + 18	2.6212	1.6342	6.5404

$\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-30. THERMODYNAMIC PROPERTIES OF ARGON (Continued)

T = 12,000 K

log $\rho/\rho_0$	Z	Moles	E/RT	H/RT	S/R	log <sub>10</sub> P	N(E)†	C <sub>p</sub> /R	C <sub>v</sub> /R	a/a <sub>0</sub>
-5.0	1.96966	1.97102	17.8020	19.7717	56.3866	-3.0624	2.61 + 14	13.8208	10.7732	8.1027
-4.8	1.95381	1.95548	17.5399	19.4937	55.2208	-2.8659	4.07 + 14	18.1228	14.4797	7.9430
-4.6	1.93076	1.93279	17.1577	19.0884	53.9438	-2.6711	6.30 + 14	24.0504	19.5007	7.7997
-4.4	1.89835	1.90078	16.6191	18.5174	52.5232	-2.4784	9.64 + 14	31.6594	25.7961	7.6657
-4.2	1.85484	1.85768	15.8943	17.7491	50.9338	-2.2885	1.45 + 15	40.5410	32.9236	7.5211
-4.0	1.79956	1.80280	14.9718	16.7714	49.1695	-2.1017	2.16 + 15	49.6798	39.9900	7.3879
-3.8	1.73355	1.73714	13.8687	15.6022	47.2525	-1.9179	3.14 + 15	57.6164	45.8652	7.2322
-3.6	1.65961	1.66346	12.6312	14.2908	45.2335	-1.7368	4.48 + 15	62.9469	49.5971	7.0651
-3.4	1.58165	1.58568	11.3251	12.9067	43.1811	-1.5577	6.27 + 15	64.8736	50.7572	6.8913
-3.2	1.50381	1.50791	10.0195	11.5233	41.1652	-1.3796	8.61 + 15	63.4370	49.5009	6.7176
-3.0	1.42960	1.43366	8.7734	10.2030	39.2439	-1.2016	1.17 + 16	59.3379	46.3780	6.5507
-2.8	1.36147	1.36549	7.6285	8.9800	37.4566	-1.0228	1.56 + 16	53.5596	42.0742	6.3961
-2.6	1.30081	1.30461	6.6080	7.9088	35.8235	-.8426	2.06 + 16	47.0373	37.2186	6.2577
-2.4	1.24809	1.25167	5.7202	6.9683	34.3492	-.6606	2.69 + 16	40.4836	32.2930	6.1377
-2.2	1.20313	1.20648	4.9623	6.1654	33.0272	-.4765	3.50 + 16	34.3527	27.6174	6.0366
-2.0	1.16535	1.16846	4.3249	5.4902	31.8447	-.2904	4.53 + 16	28.8818	23.3735	5.9544
-1.8	1.13398	1.13684	3.7949	4.9289	30.7856	-.1022	5.83 + 16	24.1545	19.6418	5.8900
-1.6	1.10817	1.11079	3.3583	4.4665	29.8329	-.0878	7.48 + 16	20.1604	16.4355	5.8425
-1.4	1.08710	1.08947	3.0012	4.0883	28.9705	.2794	9.57 + 16	16.8387	13.7273	5.8104
-1.2	1.06998	1.07212	2.7107	3.7807	28.1835	.4726	1.22 + 17	14.1068	11.4692	5.7927
-1.0	1.05616	1.05807	2.4754	3.5315	27.4587	.6669	1.56 + 17	11.8780	9.6048	5.7881
-.8	1.04504	1.04672	2.2854	3.3304	26.7850	.8623	1.99 + 17	10.0700	8.0769	5.7956
-.6	1.03615	1.03757	2.1324	3.1686	26.1529	1.0586	2.54 + 17	8.6094	6.8319	5.8140
-.4	1.02910	1.03022	2.0095	3.0386	25.5545	1.2556	3.23 + 17	7.4329	5.8221	5.8423
-.2	1.02356	1.02432	1.9109	2.9345	24.9833	1.4533	4.12 + 17	6.4874	5.0057	5.8793
-.0	1.01932	1.01960	1.8319	2.8513	24.4340	1.6515	5.27 + 17	5.7286	4.3476	5.9237
.2	1.01623	1.01581	1.7688	2.7850	23.9022	1.8502	6.73 + 17	5.1205	3.8183	5.9741
.4	1.01424	1.01278	1.7184	2.7326	23.3843	2.0493	8.63 + 17	4.6337	3.3936	6.0296
.6	1.01340	1.01036	1.6782	2.6916	22.8774	2.2490	1.11 + 18	4.2443	3.0535	6.0892
.8	1.01392	1.00844	1.6464	2.6604	22.3788	2.4492	1.43 + 18	3.9335	2.7820	6.1531
1.0	1.01624	1.00691	1.6215	2.6377	21.8865	2.6502	1.86 + 18	3.6858	2.5664	6.2225
1.2	1.02110	1.00570	1.6023	2.6234	21.3983	2.8522	2.43 + 18	3.4895	2.3965	6.3005
1.4	1.02975	1.00477	1.5881	2.6178	20.9120	3.0559	3.22 + 18	3.3352	2.2649	6.3931
1.6	1.04422	1.00406	1.5785	2.6227	20.4251	3.2620	4.34 + 18	3.2163	2.1663	6.5105
1.8	1.06775	1.00356	1.5735	2.6413	19.9344	3.4716	6.04 + 18	3.1290	2.0979	6.6683
2.0	1.10549	1.00327	1.5741	2.6705	19.4351	3.6867	8.79 + 18	3.0740	2.0608	6.8895

† N(E) is the number of electrons per cm<sup>3</sup>, expressed in the form a + b, meaning a × 10<sup>b</sup>.

TABLE 4h-30. THERMODYNAMIC PROPERTIES OF ARGON (Continued)

 $T = 14,000$  K

$\log \rho/\rho_0$	$Z$	Moles	$E/RT$	$H/RT$	$S/R$	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	2.00182	2.00297	16.2050	18.2069	57.4144	-2.9884	2.70 + 14	9.4008	7.0151	9.0622
-4.8	1.99786	1.99929	16.1296	18.1275	56.4181	-2.7893	4.26 + 14	8.4235	6.1023	9.1895
-4.6	1.99368	1.99546	16.0595	18.0532	55.4288	-2.5902	6.72 + 14	8.1468	5.8214	9.2404
-4.4	1.98849	1.99072	15.9807	17.9691	54.4330	-2.3914	1.06 + 15	8.5071	6.1086	9.1991
-4.2	1.98137	1.98415	15.8778	17.8592	53.4160	-2.1929	1.67 + 15	9.5486	6.9931	9.0803
-4.0	1.97111	1.97455	15.7326	17.7037	52.3606	-1.9952	2.62 + 15	11.4085	8.5810	8.9179
-3.8	1.95615	1.96039	15.5218	17.4779	51.2452	-1.7985	4.09 + 15	14.2902	11.0251	8.7442
-3.6	1.93458	1.93974	15.2168	17.1514	50.0441	-1.6033	6.34 + 15	18.3997	14.4624	8.5767
-3.4	1.90430	1.91049	14.7866	16.6909	48.7296	-1.4101	9.74 + 15	23.8214	18.9035	8.4182
-3.2	1.86344	1.87073	14.2035	16.0669	47.2786	-1.2196	1.48 + 16	30.3428	24.0973	8.2626
-3.0	1.81108	1.81946	13.4529	15.2640	45.6815	-1.0319	2.20 + 16	37.3149	29.4596	8.1018
-2.8	1.74784	1.75721	12.5426	14.2004	43.0514	.8474	3.22 + 16	43.7030	34.1758	7.9207
-2.6	1.67606	1.68624	11.5060	13.1821	42.1262	-.6656	4.63 + 16	48.4041	37.4782	7.7485
-2.4	1.59939	1.61013	10.3954	11.9948	40.2614	-.4859	6.53 + 16	50.6621	38.9300	7.5591
-2.2	1.52189	1.53293	9.2696	10.7915	38.4170	-.3075	9.40 + 16	50.3277	38.5294	7.3689
-2.0	1.44720	1.45828	8.1817	9.6289	36.6457	-.1293	1.23 + 17	47.8011	36.6121	7.1850
-1.8	1.37798	1.38888	7.1711	8.5491	34.9849	.0494	1.66 + 17	43.7771	33.6659	7.0135
-1.6	1.31585	1.32641	6.2619	7.5777	33.4557	.2293	2.20 + 17	38.9803	30.1724	6.8589
-1.4	1.26150	1.27157	5.4643	6.7258	32.0650	.4110	2.91 + 17	33.9995	26.5204	6.7237
-1.2	1.21488	1.22440	4.7786	5.9935	30.8094	.5947	3.80 + 17	29.2345	22.9808	6.6091
-1.0	1.17554	1.18445	4.1982	5.3737	29.6790	.7804	4.96 + 17	24.9120	19.7177	6.5149
-.8	1.14275	1.15102	3.7130	4.8557	28.6602	.9681	6.43 + 17	21.1295	16.8129	6.4402
-.6	1.11571	1.12332	3.3111	4.4268	27.7385	1.1577	8.32 + 17	17.9011	14.2916	6.3837
-.4	1.09361	1.10053	2.9808	4.0744	26.8907	1.3490	1.08 + 18	15.1935	12.1435	6.3440
-.2	1.07571	1.08190	2.7109	3.7866	26.1305	1.5418	1.39 + 18	12.9506	10.3389	6.3194
-.0	1.06135	1.06673	2.4914	3.5528	25.4190	1.7360	1.79 + 18	11.1092	8.8390	6.3086
.2	1.05003	1.05443	2.3136	3.3636	24.7552	1.9313	2.32 + 18	9.6072	7.6027	6.3103
.4	1.04134	1.04449	2.1700	3.2114	24.1302	2.1277	3.00 + 18	8.3881	6.5908	6.3233
.6	1.03505	1.03649	2.0546	3.0896	23.5367	2.3251	3.90 + 18	7.4026	5.7674	6.3470
.8	1.03113	1.03007	1.9621	2.9933	22.9686	2.5234	5.10 + 18	6.6092	5.1015	6.3812
1.0	1.02977	1.02495	1.8886	2.9184	22.4207	2.7229	6.70 + 18	5.9735	4.5671	6.4267
1.2	1.03194	1.02091	1.8309	2.8625	21.8884	2.9236	8.90 + 18	5.4680	4.1429	6.4858
1.4	1.03749	1.01778	1.7867	2.8242	21.3680	3.1261	1.20 + 19	5.0716	3.8131	6.5631
1.6	1.04942	1.01546	1.7545	2.8039	20.8556	3.3311	1.65 + 19	4.7699	3.5671	6.6667
1.8	1.07031	1.01392	1.7341	2.8044	20.3475	3.5396	2.36 + 19	4.5569	3.4024	6.8091
2.0	1.10481	1.01328	1.7270	2.8318	19.8402	3.7534	3.57 + 19	4.4420	3.3310	7.0070

$^\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-30. THERMODYNAMIC PROPERTIES OF ARGON (Continued)

T = 16,000 K

$\log p/p_0$	Z	Moles	E/RT	H/RT	S/R	$\log_{10} P$	$N(E)^\dagger$	$C_p/R$	$C_v/R$	$a/a_0$
-5.0	2.10148	2.10270	16.7027	18.8042	60.0565	-2.9094	2.96 + 14	51.3510	43.5643	9.1366
-4.8	2.06759	2.06901	15.9723	18.0399	58.3666	-2.7164	4.55 + 14	37.9023	32.1211	9.1189
-4.6	2.04341	2.04508	15.4552	17.4986	56.9032	-2.5215	7.05 + 14	27.6685	23.2395	9.1467
-4.4	2.02639	2.02840	15.0976	17.1240	55.6088	-2.3252	1.10 + 15	20.3499	16.7869	9.2207
-4.2	2.01427	2.01672	14.8515	16.8657	54.4324	-2.1278	1.72 + 15	15.3947	12.3643	9.3367
-4.0	2.00512	2.00814	14.6776	16.6827	53.3331	-1.9297	2.71 + 15	12.2402	9.5191	9.4783
-3.8	1.99738	2.00111	14.5452	16.5426	52.2791	-1.7314	4.26 + 15	10.4361	7.8696	9.6114
-3.6	1.98967	1.99430	14.4293	16.4190	51.2452	-1.5331	6.71 + 15	9.6847	7.1537	9.6899
-3.4	1.98066	1.98640	14.3081	16.2888	50.2097	-1.3351	1.06 + 16	9.8374	7.2328	9.6807
-3.2	1.96888	1.97598	14.1598	16.1287	49.1519	-1.1377	1.65 + 16	10.8736	8.0740	9.5860
-3.0	1.95262	1.96136	13.9605	15.9132	48.0495	-.9413	2.58 + 16	12.8644	9.7163	9.4368
-2.8	1.92992	1.94056	13.6837	15.6136	46.8783	-.7463	4.01 + 16	15.9107	12.2114	9.2662
-2.6	1.89871	1.91148	13.3014	15.2001	45.6141	-.5534	6.15 + 16	20.0386	15.5326	9.0918
-2.4	1.85723	1.87227	12.7897	14.6469	44.2372	-.3630	9.33 + 16	25.0616	19.4696	8.9163
-2.2	1.80466	1.82198	12.1363	13.9410	42.7403	-.1755	1.39 + 17	30.4743	23.5737	8.7355
-2.0	1.74169	1.76111	11.3481	13.0898	41.1352	.0091	2.05 + 17	35.4890	27.2312	8.5452
-1.8	1.67963	1.69181	10.4531	12.1237	39.4543	.1910	2.95 + 17	39.2635	19.8632	8.3450
-1.6	1.59500	1.61749	9.4951	11.0901	37.7443	.3709	4.17 + 17	41.2109	31.1302	8.1386
-1.4	1.51870	1.54198	8.5235	10.0422	36.0559	.5496	5.80 + 17	41.1887	31.0114	7.9324
-1.2	1.44519	1.46877	7.5829	9.0281	34.4330	.7280	7.95 + 17	39.4686	29.7379	7.7334
-1.0	1.37705	1.40048	6.7069	8.0839	32.9074	.9071	1.08 + 18	30.5555	27.6609	7.5470
-.8	1.31584	1.33877	5.9162	7.2320	31.4971	1.0873	1.44 + 18	32.9919	25.1353	7.3801
-.6	1.26221	1.28437	5.2202	6.4824	30.2078	1.2692	1.92 + 18	29.2300	22.4534	7.2326
-.4	1.21617	1.23737	4.6196	5.8358	29.0369	1.4531	2.54 + 18	25.5861	19.8239	7.1065
-.2	1.17729	1.19738	4.1094	5.2866	27.0758	1.6390	3.35 + 18	22.2469	17.3771	7.0014
-.0	1.14493	1.16380	3.6812	4.8261	27.0132	1.8269	4.40 + 18	19.2997	15.1819	6.9164
.2	1.11837	1.13586	3.3255	4.4439	26.1366	2.0167	5.79 + 18	16.7662	13.2644	6.8500
.4	1.09691	1.11283	3.0325	4.1294	25.3337	2.2083	7.62 + 18	14.6294	11.6230	6.8008
.6	1.07999	1.09398	2.7929	3.8729	24.5930	2.4015	1.01 + 19	12.8530	10.2408	6.7676
.8	1.06722	1.07869	2.5985	3.6657	23.9044	2.5964	1.33 + 19	11.3939	9.0938	6.7497
1.0	1.05847	1.06642	2.4422	3.5007	23.2588	2.7928	1.78 + 19	10.2097	7.1565	6.7474
1.2	1.05395	1.05674	2.3186	3.3725	22.6490	2.9909	2.42 + 19	9.2635	7.4061	6.7626
1.4	1.05437	1.04935	2.2234	3.2778	22.0689	3.1911	3.33 + 19	8.5272	6.8261	6.7001
1.6	1.06109	1.04415	2.1545	3.2156	21.5128	3.3939	4.72 + 19	7.9869	6.4112	6.8633
1.8	1.07634	1.04136	2.1128	3.1892	20.9794	3.6001	7.01 + 19	7.6550	6.1803	6.9645
2.0	1.10300	1.04211	2.1070	3.2100	20.4722	3.8107	1.13 + 20	7.6148	6.2191	7.1095

$\dagger N(E)$  is the number of electrons per  $\text{cm}^3$ , expressed in the form  $a + b$ , meaning  $a \times 10^b$ .

TABLE 4h-31. THERMODYNAMIC PROPERTIES OF HIGHLY IONIZED NITROGEN, OXYGEN, AND AIR†

log C <sub>s</sub>	Nitrogen				Oxygen				Air			
	$\rho/\rho_0$	Z*	E*/RT	P, atm	$\rho/\rho_0$	Z*	E*/RT	P, atm	$\rho/\rho_0$	Z*	E*/RT	P, atm
	log T = 4.4 T = 25,119 K											
-5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
-4	5.493(-5)	2.8203	22.4434	1.4247(-2)	6.658(-5)	2.5019	18.6759	1.5319(-2)	2.852(-5)	5.934	50.209	1.386(-3)
-3	7.621(-4)	2.3121	14.7619	1.5204(-1)	9.163(-4)	2.0914	11.5787	1.7622(-1)	3.951(-4)	5.506	43.302	1.445(-2)
-2	9.667(-3)	2.0344	10.6227	1.8086	9.914(-3)	2.0087	10.1592	1.8313	4.859(-3)	4.531	28.177	1.646(-1)
-1	0.1087	1.9197	9.4752	1.91894(1)	0.1012	1.9877	9.9100	1.8499(1)	5.353(-2)	4.058	21.049	1.813
0	1.9252	1.5194	6.4984	2.6899(2)	1.1668	1.8570	8.9608	1.9925(2)	0.8462	3.868	19.134	1.9042(1)
										3.182	14.038	2.50(2)
	log T = 4.6 T = 39,811 K											
-5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
-4	3.608(-5)	3.7715	30.2600	1.9833(-2)	4.047(-5)	3.4711	27.3687	2.0475(-2)	1.68(-6)	7.957	68.511	1.949(-3)
-3	4.460(-4)	3.2434	21.8559	2.1081(-1)	4.837(-4)	3.0672	20.3529	2.1623(-1)	1.846(-5)	7.416	59.297	1.995(-2)
-2	5.087(-3)	2.9657	17.7766	2.1989	5.327(-3)	2.8772	17.7458	2.2339	2.266(-1)	6.412	43.076	2.118(-1)
-1	6.320(-2)	2.5823	13.7697	2.3786(1)	7.186(-2)	2.3917	12.2432	2.5050(1)	2.568(-3)	5.894	35.540	2.207
0	0.9484	2.0544	8.8117	2.8398(2)	1.0159	1.9843	8.1263	2.9381(2)	3.242(-2)	5.084	26.894	2.402(1)
+1	1.71167(1)	1.5842	6.3699	3.95214(3)	1.77836(1)	1.5623	5.9211	4.04935(3)	0.4810	4.079	17.333	2.860(2)
										3.159	12.550	3.973(3)
	log T = 4.8 T = 63,096 K											
-5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
-4	2.456(-5)	5.0711	40.7265	2.8770(-2)	2.589(-5)	4.8626	39.9829	2.9080(-2)	1.11(-6)	11.006	98.885	2.822(-3)
-3	2.755(-4)	4.6204	33.6748	0.2946	3.000(-4)	4.3333	31.2774	0.3003	1.22(-5)	10.054	81.138	2.884(-2)
-2	3.252(-3)	4.0752	25.5689	3.0614	3.423(-3)	3.9217	25.0767	3.1009	1.402(-4)	9.134	66.335	0.2958
-1	3.879(-2)	3.5778	19.8189	3.2057(1)	4.184(-2)	3.3899	18.7528	3.2762(1)	1.643(-3)	8.085	50.930	3.070
0	0.5297	2.8880	13.4425	3.5337(2)	0.5383	2.8576	13.4707	3.5531(2)	1.970(-2)	7.076	39.187	3.221(1)
+1	8.6176	2.1604	9.004	4.30041(3)	8.8718	2.1272	8.8848	4.35924(3)	0.26574	5.763	26.897	3.538(2)
										4.307	17.953	4.31288(3)

\* Air is taken to be 0.78847N<sub>2</sub> + 0.21153O<sub>2</sub>.

† The symbols Z\* and E\* refer to the compressibility factor and energy, respectively, of the gas mixture in the ideal gas approximation, with dissociation and ionization effects included, but without intermolecular and ionic force corrections.

TABLE 4h-31. THERMODYNAMIC PROPERTIES OF HIGHLY IONIZED NITROGEN, OXYGEN, AND AIR (Continued)

log $C_e$	Nitrogen					Oxygen					Air				
	$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P$ , atm		$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P$ , atm		$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P$ , atm	
	log $T = 5.0 \quad T = 100,000 \text{ K}$														
-5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
-4	2.002(-5)	5.9941	39.9015	4.3932(-2)	.....	1.775(-5)	6.6336	54.5680	4.3108(-2)	.....	9.62(-7)	12.400	88.347	4.367(-3)	
-3	2.023(-4)	5.9442	39.2902	0.4402	.....	1.985(-4)	6.0370	44.7463	0.4387	.....	9.75(-6)	12.289	86.008	4.376(-2)	
-2	2.166(-3)	5.6159	35.2938	4.4532	.....	2.264(-3)	5.4160	35.7412	4.4891	.....	1.007(-4)	11.928	80.888	0.4398	
-1	2.530(-2)	4.9529	27.6217	4.5876(1)	.....	2.653(-2)	4.7695	27.5515	4.6323(1)	.....	1.093(-3)	11.147	70.777	4.461	
0	0.31486	4.1760	20.2730	4.8137(2)	.....	0.3312	4.0197	19.9701	4.8739(2)	.....	1.2774(-2)	9.828	55.214	4.596(1)	
+1	4.5067	3.2189	13.8801	5.3108(3)	.....	4.7320	3.1133	13.6880	5.3934(3)	.....	2.2736	8.286	40.418	4.826(2)	
	log $T = 5.2 \quad T = 158,490 \text{ K}$														
-5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
-4	2.000(-5)	5.9999	28.5422	6.9627(-2)	.....	1.667(-5)	6.9990	42.1981	6.769(-2)	.....	9.595(-6)	12.422	62.862	6.92(-2)	
-3	2.000(-4)	5.9994	28.5379	0.6962	.....	1.669(-4)	6.9902	42.1008	0.6770	.....	9.599(-5)	12.418	62.814	0.692	
-2	2.003(-3)	5.9937	28.4949	6.9641	.....	1.692(-3)	6.9085	41.2041	6.7823	.....	9.6395(-4)	12.374	62.367	6.92	
-1	2.025(-2)	5.9392	28.0852	6.9784(1)	.....	1.835(-2)	6.4490	36.2326	6.8664(1)	.....	9.9069(-3)	12.094	59.617	6.95(1)	
0	0.2194	5.5589	25.2956	7.0764(2)	.....	0.2175	5.5974	27.9500	7.0637(2)	.....	0.1095	11.134	51.714	7.074(2)	
+1	2.8280	4.5360	18.8699	7.4431(3)	.....	2.8802	4.4719	19.7684	7.4734(3)	.....	1.4194	9.045	38.120	7.449(3)	
	log $T = 5.4 \quad T = 251,190 \text{ K}$														
-5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
-4	1.998(-5)	6.0038	21.4332	1.1031(-1)	.....	1.667(-5)	7.0000	30.5070	0.1073	.....	9.5(-7)	12.481	48.109	1.090(-2)	
-3	2.000(-4)	6.0003	21.3407	1.1036	.....	1.667(-4)	6.9998	30.5059	1.0731	.....	9.59(-6)	12.429	46.705	0.110	
-2	2.000(-3)	5.9995	21.3298	1.1034(1)	.....	1.667(-3)	6.9981	30.4954	1.0728(1)	.....	9.594(-5)	12.423	46.559	1.097	
-1	2.002(-2)	5.9945	21.3127	1.1035(2)	.....	1.672(-2)	6.9814	30.3921	1.0734(2)	.....	9.596(-4)	12.421	46.537	1.097(1)	
0	0.2022	5.9465	21.1549	1.1057(3)	.....	0.1715	6.8305	29.4678	1.0772(3)	.....	9.609(-3)	12.407	46.467	1.097(2)	
+1	2.1844	5.5780	19.9145	1.12054(4)	.....	1.9859	6.0354	24.9055	1.10221(4)	.....	1.070	11.350	41.941	1.1170(4)	



TABLE 4b-31. THERMODYNAMIC PROPERTIES OF HIGHLY IONIZED NITROGEN, OXYGEN, AND AIR (Continued)

log $C_e$	Nitrogen				Oxygen				Air			
	$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P, \text{ atm}$	$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P, \text{ atm}$	$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P, \text{ atm}$
	$\log T = 5.6 \quad T = 338,110 \text{ K}$											
-5	1.553(-5)	7.4409	43.5716	0.1684	1.591(-5)	7.2854	29.2764	1.689(-1)	7.80(-6)	14.816	81.096	0.1685
-4	1.673(-4)	6.9782	34.2161	1.7016	1.656(-4)	7.0382	23.9473	1.6987	8.346(-5)	13.982	64.088	1.701
-3	1.822(-3)	6.4876	25.3735	1.7227(1)	1.666(-3)	7.0037	23.2082	1.7006(1)	8.934(-4)	13.194	49.831	1.718(1)
-2	1.967(-2)	6.0831	18.2776	1.7437(2)	1.667(-2)	6.9973	23.1256	1.7001(2)	9.476(-3)	12.553	38.606	1.734(2)
-1	0.20046	5.9883	16.9174	1.7496(3)	0.1675	6.9700	23.0593	1.70157(3)	9.523(-2)	12.392	36.433	1.739(3)
+1	2.0749	5.8194	16.5657	1.7599(4)	1.7409	6.7442	22.5449	1.7112(4)	0.9970	12.300	35.661	1.7500(4)
$\log T = 5.8 \quad T = 630,960 \text{ K}$												
-5	1.429(-5)	7.9995	39.3190	0.2610	1.253(-5)	8.9802	50.7353	0.2599	6.9(-7)	16.422	83.609	2.62(-2)
-4	1.430(-4)	7.9953	39.2610	2.6410	1.277(-4)	8.8308	48.1188	2.6049	6.94(-6)	16.414	83.468	0.2631
-3	1.438(-3)	7.9547	38.7050	2.6423(1)	1.371(-3)	8.2929	38.7624	2.6264	6.972(-5)	16.344	82.269	2.633
-2	1.499(-2)	7.6706	34.8243	2.6560(2)	1.485(-2)	7.7337	29.6449	2.6530(2)	7.116(-4)	16.052	77.434	2.639(1)
-1	0.1657	7.0362	26.4910	2.6932(3)	0.1621	7.1689	21.2538	2.6843(3)	7.481(-3)	15.368	67.457	2.655(2)
+1	1.8873	6.2987	18.8607	2.7459(4)	1.7010	6.8787	18.6828	2.7028(4)	0.08245	14.128	50.766	2.691(3)
$\log T = 6.0 \quad T = 1,000,000 \text{ K}$												
-5	1.429(-5)	8.0000	29.2413	0.4184	1.250(-5)	9.0000	37.2123	0.41186	6.93(-7)	16.423	61.855	4.17(-2)
-4	1.429(-4)	8.0000	29.2410	4.184	1.250(-4)	8.9997	37.2095	4.1186	6.933(-6)	16.423	61.855	0.417
-3	1.429(-3)	7.9996	29.2388	4.1839(1)	1.250(-3)	8.9971	37.1809	4.1186(1)	6.934(-5)	16.421	61.838	4.17
-2	1.4286(-2)	7.9961	29.2170	4.1820(3)	1.254(-2)	8.9719	36.9010	4.1186(2)	6.934(-4)	16.405	61.885	4.17(1)
-1	0.1436	7.9618	29.0039	4.1856(3)	0.1288	8.7657	34.6534	4.133(3)	6.942(-3)	16.405	61.685	4.17(2)
+1	1.498	7.6748	27.2651	4.2090(4)	1.4231	8.0268	27.3929	4.1819(4)	0.07011	16.264	60.398	4.175(3)
									0.74082	15.498	54.584	4.2033(4)

at uniform logarithmic intervals to 2.5 million kelvins. The tables taken from Hilsenrath, Green, and Beckett [4] represent the properties of atoms in equilibrium with their ions. The formulation in terms of electron concentration permits a solution of the equations for equilibrium properties in closed form and allows the computation of properties of a mixture directly from the equilibrium properties of the constituent gases. In these tables the asterisk refers to properties of the gas mixture in the ideal-gas approximation (with dissociation and ionization effects included but without intermolecular and ionic force corrections).

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TABLE 4b-31. THERMODYNAMIC PROPERTIES OF HIGHLY IONIZED NITROGEN, OXYGEN, AND AIR (Continued)

log $C_e$	Nitrogen				Oxygen				Air			
	$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P, \text{ atm}$	$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P, \text{ atm}$	$\rho/\rho_0$	$Z^*$	$E^*/RT$	$P, \text{ atm}$
	$\log T = 6.2 \quad T = 1,584,900 \text{ K}$											
-5	1.429(-5)	8.0000	22.8785	0.6631	1.250(-5)	9.0000	28.4617	0.65276	6.993(-6)	16.423	48.119	0.661
-4	1.429(-4)	8.0000	22.8785	6.631	1.250(-4)	9.0000	28.4616	6.5276	6.933(-5)	16.423	48.119	6.61
-3	1.429(-3)	7.9999	22.8784	6.631(1)	1.250(-3)	8.9999	28.4614	6.5276(1)	6.934(-4)	16.423	48.119	6.61(1)
-2	1.429(-2)	7.9988	22.8777	6.630(2)	1.250(-2)	8.9985	28.4587	6.5265(2)	6.935(-3)	16.420	48.116	6.61(2)
-1	0.1431	7.9881	22.8705	6.6326(3)	0.1252	8.9851	28.4318	6.527(3)	6.945(-2)	16.398	48.094	6.609(3)
0	1.4510	7.8916	22.8025	6.6440(4)	1.2717	8.8631	28.1745	6.5402(4)	0.7045	16.194	47.878	6.6200(4)
$\log T = 6.4 \quad T = 2,511,900 \text{ K}$												
-5	1.429(-5)	8.0000	18.8639	1.051	1.250(-5)	9.0000	22.9401	1.035	6.933(-5)	16.423	39.452	1.047(1)
-4	1.429(-4)	8.0000	18.8639	1.051(1)	1.250(-4)	9.0000	22.9402	1.0346(1)	6.933(-4)	16.423	39.452	1.047(2)
-3	1.429(-3)	7.9999	18.8638	1.051(2)	1.250(-3)	8.9999	22.9401	1.0346(2)	6.934(-3)	16.421	39.452	1.047(3)
-2	1.429(-2)	7.9990	18.8637	1.051(3)	1.250(-2)	8.9989	22.9372	1.0338(4)	6.943(-2)	16.403	39.448	1.0474(4)
-1	0.14306	7.9899	18.8618	1.0511(4)	0.12516	8.9896	22.9124	1.0359(5)	0.7024	16.237	39.411	1.0490(5)
0	1.4477	7.9074	18.8150	1.0527(5)	1.2651	8.9043	22.9124	1.0359(5)				