THE CALCULATED PROPERTIES OF HELIUM II

by

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Preface

There is a continual need for a consistent set of experimental data on helium II. Compilations have been given in the Appendix of Wilks's "The Properties of Liquid and Solid Helium" and Donnelly's "Experimental Superfluidity." Since then, it has become increasingly evident that all quantities must be known as a function of pressure as well as temperature, and an inspection of experimental data shows that there are many gaps in the (T,P)-plane and not a few inconsistencies. We have decided to try to provide an interim solution to this problem by producing empirical formulae which represent the data over the complete range, excluding the transition region near the λ-line. The results of these calculations are tabulated in increments of 0.05 K in temperature from 0.1 K to 2.10 K, and in increments of 2.5 atmospheres from 0 to 25 atmospheres. The tables are presented in Part I and are printed on colored sheets to facilitate reference to different properties.

The reliability of each table varies, and in some cases the experimental data are inconsistent. Although most tables are believed to agree with experiment to within $\pm$ 10% below 1.6 K, the discussions of Part II, and where necessary the original data, should be consulted when accuracy is necessary.

The authors are acutely aware of the limitations of these tables and would appreciate receiving suggestions to improve them as well as copies of new experimental data as it becomes available. The success of these tables will be measured, in part, by the speed with which they are superseded.

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Contents

Part I

The Tables

1. Use of the Tables

These tables are derived from the equation of state and the model dispersion curve (MDC) method. Several considerations should be observed when using the tables:

(i) As a rule of thumb, the tables can be expected to be most accurate below 1.60 K.

(ii) The worst agreement of tabulated values with the data is often at the vapor pressure. The tables may be less reliable near the λ-line, and certainly no attempt should be made to use them in scaling relations.

(iii) All numbers are the result of continuous functions, and each number has been given as many figures as space allows to provide a continuous tabulation for numerical analysis. The relation .34756E + 05 implies that the number 0.34756 is to be multiplied by 10^{+5} (where $E \pm n = 10^{\pm n}$).

(iv) The highest temperature for which data is listed in each pressure column corresponds to the temperature at which the calculated normal fluid density starts to exceed the total density, ($\rho_n/\rho = 1$) and represents the "lambda line" of the model calculation.

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PART I

Index to Tables (continued)

TABLE I. DENSITY ($gm \cdot cm^{-3}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.14513E+00	.14925E+00	.15284E+00	.15603E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.15	.14513E+00	.14925E+00	.15284E+00	.15603E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.20	.14513E+00	.14925E+00	.15284E+00	.15603E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.25	.14513E+00	.14925E+00	.15283E+00	.15603E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.30	.14513E+00	.14925E+00	.15283E+00	.15602E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.35	.14513E+00	.14925E+00	.15283E+00	.15602E+00	.15891E+00	.16157E+00	.16403E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.40	.14513E+00	.14925E+00	.15283E+00	.15602E+00	.15891E+00	.16157E+00	.16403E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.45	.14513E+00	.14925E+00	.15283E+00	.15602E+00	.15891E+00	.16156E+00	.16402E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.50	.14513E+00	.14924E+00	.15283E+00	.15602E+00	.15891E+00	.16156E+00	.16402E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.55	.14512E+00	.14924E+00	.15282E+00	.15601E+00	.15891E+00	.16156E+00	.16402E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.60	.14512E+00	.14924E+00	.15282E+00	.15601E+00	.15891E+00	.16156E+00	.16402E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.65	.14512E+00	.14924E+00	.15282E+00	.15601E+00	.15890E+00	.16156E+00	.16402E+00	.16632E+00	.16848E+00	.17053E+00	.17246E+00
.70	.14512E+00	.14923E+00	.15282E+00	.15601E+00	.15890E+00	.16156E+00	.16402E+00	.16633E+00	.16849E+00	.17053E+00	.17247E+00
.75	.14511E+00	.14923E+00	.15282E+00	.15601E+00	.15891E+00	.16156E+00	.16403E+00	.16633E+00	.16850E+00	.17054E+00	.17248E+00
.80	.14511E+00	.14923E+00	.15282E+00	.15601E+00	.15891E+00	.16157E+00	.16404E+00	.16634E+00	.16851E+00	.17055E+00	.17250E+00
.85	.14511E+00	.14923E+00	.15282E+00	.15601E+00	.15891E+00	.16158E+00	.16405E+00	.16635E+00	.16852E+00	.17057E+00	.17251E+00
.90	.14511E+00	.14923E+00	.15282E+00	.15602E+00	.15892E+00	.16159E+00	.16406E+00	.16637E+00	.16854E+00	.17059E+00	.17254E+00
.95	.14511E+00	.14923E+00	.15282E+00	.15603E+00	.15893E+00	.16160E+00	.16408E+00	.16639E+00	.16856E+00	.17062E+00	.17257E+00
1.00	.14511E+00	.14923E+00	.15283E+00	.15604E+00	.15895E+00	.16162E+00	.16410E+00	.16642E+00	.16860E+00	.17065E+00	.17261E+00
1.05	.14510E+00	.14924E+00	.15284E+00	.15605E+00	.15897E+00	.16165E+00	.16413E+00	.16645E+00	.16864E+00	.17070E+00	.17266E+00
1.10	.14511E+00	.14924E+00	.15285E+00	.15607E+00	.15899E+00	.16168E+00	.16417E+00	.16649E+00	.16868E+00	.17075E+00	.17271E+00

TABLE I. DENSITY ($gm \cdot cm^{-3}$) (continued)

Temp. (K)	Pressure (atm)										
	0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.14511E+00	.14924E+00	.15285E+00	.15607E+00	.15899E+00	.16168E+00	.16417E+00	.16649E+00	.16863E+00	.17075E+00	.17271E+00
1.15	.14511E+00	.14925E+00	.15286E+00	.15609E+00	.15902E+00	.16172E+00	.16421E+00	.16655E+00	.16874E+00	.17081E+00	.17278E+00
1.20	.14511E+00	.14926E+00	.15288E+00	.15612E+00	.15906E+00	.16176E+00	.16427E+00	.16661E+00	.16881E+00	.17089E+00	.17286E+00
1.25	.14511E+00	.14927E+00	.15291E+00	.15616E+00	.15911E+00	.16182E+00	.16433E+00	.16668E+00	.16889E+00	.17098E+00	.17296E+00
1.30	.14512E+00	.14929E+00	.15294E+00	.15620E+00	.15916E+00	.16188E+00	.16441E+00	.16677E+00	.16898E+00	.17108E+00	.17307E+00
1.35	.14513E+00	.14931E+00	.15297E+00	.15625E+00	.15922E+00	.16196E+00	.16450E+00	.16687E+00	.16910E+00	.17120E+00	.17320E+00
1.40	.14514E+00	.14934E+00	.15302E+00	.15631E+00	.15930E+00	.16205E+00	.16460E+00	.16698E+00	.16923E+00	.17134E+00	.17336E+00
1.45	.14515E+00	.14937E+00	.15307E+00	.15638E+00	.15939E+00	.16215E+00	.16472E+00	.16712E+00	.16938E+00	.17151E+00	.17353E+00
1.50	.14517E+00	.14941E+00	.15313E+00	.15646E+00	.15949E+00	.16227E+00	.16486E+00	.16727E+00	.16955E+00	.17170E+00	.17374E+00
1.55	.14519E+00	.14945E+00	.15320E+00	.15655E+00	.15960E+00	.16241E+00	.16502E+00	.16745E+00	.16975E+00	.17191E+00	.17397E+00
1.60	.14521E+00	.14950E+00	.15328E+00	.15666E+00	.15974E+00	.16257E+00	.16520E+00	.16766E+00	.16997E+00	.17216E+00	.17423E+00
1.65	.14524E+00	.14956E+00	.15337E+00	.15679E+00	.15990E+00	.16276E+00	.16541E+00	.16790E+00	.17023E+00	.17244E+00	.17454E+00
1.70	.14527E+00	.14963E+00	.15348E+00	.15693E+00	.16007E+00	.16297E+00	.16566E+00	.16817E+00	.17053E+00	.17277E+00	.17489E+00
1.75	.14531E+00	.14971E+00	.15360E+00	.15709E+00	.16028E+00	.16321E+00	.16593E+00	.16848E+00	.17087E+00	.17313E+00	.17528E+00
1.80	.14535E+00	.14980E+00	.15374E+00	.15728E+00	.16051E+00	.16349E+00	.16625E+00	.16883E+00	.17126E+00	.17356E+00	.17574E+00
1.85	.14540E+00	.14991E+00	.15390E+00	.15750E+00	.16078E+00	.16380E+00	.16661E+00	.16924E+00	.17171E+00	.17404E+00	
1.90	.14546E+00	.15003E+00	.15409E+00	.15775E+00	.16109E+00	.16417E+00	.16703E+00	.16970E+00			
1.95	.14553E+00	.15017E+00	.15430E+00	.15804E+00	.16144E+00	.16459E+00	.16751E+00				
2.00	.14561E+00	.15033E+00	.15455E+00	.15837E+00	.16185E+00						
2.05	.14570E+00	.15052E+00	.15484E+00								
2.10	.14580E+00	.15073E+00									

TABLE II. MOLAR VOLUME ($cm^3 mole^{-1}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.27579E+02	.26818E+02	.26189E+02	.25653E+02	.25186E+02	.24773E+02	.24401E+02	.24064E+02	.23756E+02	.23472E+02	.23208E+02
.15	.27579E+02	.26818E+02	.26189E+02	.25653E+02	.25186E+02	.24773E+02	.24401E+02	.24064E+02	.23756E+02	.23472E+02	.23208E+02
.20	.27579E+02	.26818E+02	.26189E+02	.25653E+02	.25186E+02	.24773E+02	.24401E+02	.24064E+02	.23756E+02	.23472E+02	.23208E+02
.25	.27579E+02	.26818E+02	.26189E+02	.25653E+02	.25187E+02	.24773E+02	.24402E+02	.24065E+02	.23756E+02	.23472E+02	.23209E+02
.30	.27579E+02	.26818E+02	.26189E+02	.25654E+02	.25187E+02	.24773E+02	.24402E+02	.24065E+02	.23756E+02	.23472E+02	.23209E+02
.35	.27580E+02	.26818E+02	.26190E+02	.25654E+02	.25187E+02	.24773E+02	.24402E+02	.24065E+02	.23757E+02	.23472E+02	.23209E+02
.40	.27580E+02	.26818E+02	.26190E+02	.25654E+02	.25187E+02	.24774E+02	.24402E+02	.24065E+02	.23757E+02	.23473E+02	.23209E+02
.45	.27580E+02	.26819E+02	.26190E+02	.25655E+02	.25188E+02	.24774E+02	.24402E+02	.24065E+02	.23757E+02	.23473E+02	.23209E+02
.50	.27580E+02	.26819E+02	.26191E+02	.25655E+02	.25188E+02	.24774E+02	.24403E+02	.24066E+02	.23757E+02	.23473E+02	.23209E+02
.55	.27581E+02	.26820E+02	.26191E+02	.25655E+02	.25188E+02	.24774E+02	.24403E+02	.24066E+02	.23757E+02	.23473E+02	.23209E+02
.60	.27581E+02	.26820E+02	.26191E+02	.25656E+02	.25189E+02	.24775E+02	.24403E+02	.24066E+02	.23757E+02	.23473E+02	.23209E+02
.65	.27581E+02	.26820E+02	.26192E+02	.25656E+02	.25189E+02	.24775E+02	.24403E+02	.24065E+02	.23757E+02	.23472E+02	.23208E+02
.70	.27582E+02	.26821E+02	.26192E+02	.25656E+02	.25189E+02	.24774E+02	.24402E+02	.24065E+02	.23756E+02	.23471E+02	.23207E+02
.75	.27582E+02	.26821E+02	.26192E+02	.25656E+02	.25188E+02	.24774E+02	.24402E+02	.24064E+02	.23755E+02	.23470E+02	.23206E+02
.80	.27583E+02	.26822E+02	.26192E+02	.25656E+02	.25188E+02	.24773E+02	.24401E+02	.24063E+02	.23753E+02	.23468E+02	.23204E+02
.85	.27583E+02	.26822E+02	.26192E+02	.25655E+02	.25187E+02	.24772E+02	.24399E+02	.24061E+02	.23751E+02	.23466E+02	.23202E+02
.90	.27584E+02	.26822E+02	.26192E+02	.25654E+02	.25186E+02	.24770E+02	.24397E+02	.24059E+02	.23749E+02	.23463E+02	.23198E+02
.95	.27584E+02	.26822E+02	.26191E+02	.25653E+02	.25184E+02	.24768E+02	.24394E+02	.24055E+02	.23745E+02	.23459E+02	.23194E+02
1.00	.27584E+02	.26821E+02	.26190E+02	.25651E+02	.25182E+02	.24765E+02	.24391E+02	.24051E+02	.23741E+02	.23454E+02	.23189E+02
1.05	.27584E+02	.26821E+02	.26189E+02	.25649E+02	.25179E+02	.24761E+02	.24387E+02	.24046E+02	.23735E+02	.23449E+02	.23183E+02
1.10	.27584E+02	.26820E+02	.26187E+02	.25646E+02	.25175E+02	.24757E+02	.24381E+02	.24040E+02	.23729E+02	.23441E+02	.23175E+02

TABLE II. MOLAR VOLUME ($cm^3 mole^{-1}$) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.27584E+02	.26820E+02	.26187E+02	.25646E+02	.25175E+02	.24757E+02	.24381E+02	.24040E+02	.23729E+02	.23441E+02	.23175E+02
1.15	.27584E+02	.26818E+02	.26184E+02	.25642E+02	.25170E+02	.24751E+02	.24374E+02	.24033E+02	.23721E+02	.23433E+02	.23166E+02
1.20	.27583E+02	.26816E+02	.26181E+02	.25638E+02	.25164E+02	.24744E+02	.24366E+02	.24024E+02	.23711E+02	.23422E+02	.23155E+02
1.25	.27582E+02	.26814E+02	.26176E+02	.25632E+02	.25157E+02	.24735E+02	.24357E+02	.24014E+02	.23700E+02	.23410E+02	.23142E+02
1.30	.27581E+02	.26811E+02	.26171E+02	.25625E+02	.25148E+02	.24725E+02	.24346E+02	.24001E+02	.23686E+02	.23396E+02	.23127E+02
1.35	.27580E+02	.26807E+02	.26165E+02	.25617E+02	.25138E+02	.24714E+02	.24333E+02	.23987E+02	.23671E+02	.23379E+02	.23109E+02
1.40	.27578E+02	.26802E+02	.26158E+02	.25607E+02	.25126E+02	.24700E+02	.24317E+02	.23970E+02	.23652E+02	.23360E+02	.23089E+02
1.45	.27575E+02	.26796E+02	.26149E+02	.25596E+02	.25113E+02	.24684E+02	.24300E+02	.23951E+02	.23632E+02	.23338E+02	.23065E+02
1.50	.27572E+02	.26790E+02	.26139E+02	.25582E+02	.25097E+02	.24666E+02	.24279E+02	.23928E+02	.23608E+02	.23312E+02	.23039E+02
1.55	.27569E+02	.26782E+02	.26127E+02	.25567E+02	.25078E+02	.24645E+02	.24255E+02	.23903E+02	.23580E+02	.23283E+02	.23008E+02
1.60	.27564E+02	.26773E+02	.26114E+02	.25549E+02	.25057E+02	.24620E+02	.24228E+02	.23873E+02	.23548E+02	.23249E+02	.22973E+02
1.65	.27559E+02	.26762E+02	.26098E+02	.25529E+02	.25033E+02	.24593E+02	.24198E+02	.23840E+02	.23512E+02	.23211E+02	.22933E+02
1.70	.27553E+02	.26750E+02	.26079E+02	.25506E+02	.25005E+02	.24561E+02	.24162E+02	.23801E+02	.23471E+02	.23168E+02	.22887E+02
1.75	.27546E+02	.26735E+02	.26059E+02	.25479E+02	.24973E+02	.24524E+02	.24122E+02	.23757E+02	.23425E+02	.23118E+02	.22835E+02
1.80	.27537E+02	.26719E+02	.26035E+02	.25448E+02	.24936E+02	.24483E+02	.24076E+02	.23708E+02	.23371E+02	.23062E+02	.22776E+02
1.85	.27528E+02	.26700E+02	.26007E+02	.25413E+02	.24895E+02	.24435E+02	.24023E+02	.23651E+02	.23310E+02	.22998E+02	
1.90	.27516E+02	.26678E+02	.25976E+02	.25373E+02	.24847E+02	.24381E+02	.23964E+02	.23586E+02			
1.95	.27504E+02	.26653E+02	.25940E+02	.25327E+02	.24792E+02	.24319E+02	.23895E+02				
2.00	.27489E+02	.26625E+02	.25898E+02	.25274E+02	.24730E+02						
2.05	.27472E+02	.26592E+02	.25851E+02								
2.10	.27453E+02	.26555E+02									

TABLE III. FIRST SOUND VELOCITY ($cm \cdot sec^{-1}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.23821E+05	.25746E+05	.27422E+05	.28916E+05	.30271E+05	.31515E+05	.32669E+05	.33747E+05	.34760E+05	.35718E+05	.36627E+05
.15	.23822E+05	.25747E+05	.27422E+05	.28916E+05	.30271E+05	.31515E+05	.32669E+05	.33747E+05	.34760E+05	.35718E+05	.36627E+05
.20	.23823E+05	.25747E+05	.27423E+05	.28917E+05	.30271E+05	.31515E+05	.32669E+05	.33747E+05	.34760E+05	.35718E+05	.36627E+05
.25	.23824E+05	.25748E+05	.27423E+05	.28917E+05	.30272E+05	.31516E+05	.32669E+05	.33747E+05	.34760E+05	.35717E+05	.36627E+05
.30	.23826E+05	.25749E+05	.27424E+05	.28918E+05	.30272E+05	.31516E+05	.32669E+05	.33746E+05	.34759E+05	.35717E+05	.36626E+05
.35	.23829E+05	.25751E+05	.27425E+05	.28918E+05	.30272E+05	.31516E+05	.32669E+05	.33746E+05	.34759E+05	.35716E+05	.36625E+05
.40	.23830E+05	.25752E+05	.27426E+05	.28918E+05	.30272E+05	.31515E+05	.32668E+05	.33745E+05	.34758E+05	.35715E+05	.36624E+05
.45	.23833E+05	.25754E+05	.27426E+05	.28918E+05	.30271E+05	.31514E+05	.32667E+05	.33743E+05	.34756E+05	.35713E+05	.36622E+05
.50	.23836E+05	.25755E+05	.27427E+05	.28918E+05	.30270E+05	.31513E+05	.32665E+05	.33741E+05	.34753E+05	.35710E+05	.36619E+05
.55	.23840E+05	.25757E+05	.27427E+05	.28917E+05	.30268E+05	.31510E+05	.32661E+05	.33737E+05	.34749E+05	.35705E+05	.36614E+05
.60	.23843E+05	.25757E+05	.27426E+05	.28914E+05	.30265E+05	.31506E+05	.32657E+05	.33732E+05	.34744E+05	.35700E+05	.36608E+05
.65	.23845E+05	.25757E+05	.27424E+05	.28911E+05	.30261E+05	.31501E+05	.32651E+05	.33726E+05	.34737E+05	.35693E+05	.36601E+05
.70	.23847E+05	.25756E+05	.27420E+05	.28906E+05	.30254E+05	.31493E+05	.32643E+05	.33718E+05	.34729E+05	.35685E+05	.36592E+05
.75	.23843E+05	.25753E+05	.27415E+05	.28899E+05	.30246E+05	.31484E+05	.32633E+05	.33708E+05	.34718E+05	.35674E+05	.36582E+05
.80	.23847E+05	.25748E+05	.27403E+05	.28890E+05	.30236E+05	.31473E+05	.32622E+05	.33696E+05	.34706E+05	.35662E+05	.36571E+05
.85	.23846E+05	.25743E+05	.27399E+05	.28879E+05	.30224E+05	.31460E+05	.32608E+05	.33681E+05	.34692E+05	.35649E+05	.36558E+05
.90	.23843E+05	.25735E+05	.27388E+05	.28865E+05	.30208E+05	.31444E+05	.32591E+05	.33665E+05	.34676E+05	.35633E+05	.36543E+05
.95	.23839E+05	.25724E+05	.27374E+05	.28849E+05	.30190E+05	.31425E+05	.32572E+05	.33646E+05	.34657E+05	.35615E+05	.36528E+05
1.00	.23832E+05	.25712E+05	.27357E+05	.28829E+05	.30169E+05	.31403E+05	.32549E+05	.33623E+05	.34636E+05	.35596E+05	.36510E+05
1.05	.23824E+05	.25696E+05	.27336E+05	.28806E+05	.30144E+05	.31377E+05	.32523E+05	.33598E+05	.34612E+05	.35574E+05	.36490E+05
1.10	.23812E+05	.25677E+05	.27312E+05	.28779E+05	.30115E+05	.31347E+05	.32493E+05	.33569E+05	.34585E+05	.35544E+05	.36469E+05

TABLE III. FIRST SOUND VELOCITY ($cm \cdot sec^{-1}$) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.23812E+05	.25677E+05	.27312E+05	.28779E+05	.30115E+05	.31347E+05	.32493E+05	.33569E+05	.34585E+05	.35548E+05	.36469E+05
1.15	.23798E+05	.25654E+05	.27284E+05	.28747E+05	.30081E+05	.31312E+05	.32459E+05	.33536E+05	.34553E+05	.35520E+05	.36444E+05
1.20	.23780E+05	.25626E+05	.27250E+05	.28710E+05	.30042E+05	.31273E+05	.32420E+05	.33498E+05	.34518E+05	.35489E+05	.36416E+05
1.25	.23758E+05	.25593E+05	.27211E+05	.28667E+05	.29997E+05	.31227E+05	.32375E+05	.33455E+05	.34478E+05	.35451E+05	.36387E+05
1.30	.23732E+05	.25555E+05	.27166E+05	.28617E+05	.29946E+05	.31175E+05	.32324E+05	.33406E+05	.34433E+05	.35414E+05	.36351E+05
1.35	.23700E+05	.25511E+05	.27114E+05	.28561E+05	.29887E+05	.31116E+05	.32266E+05	.33351E+05	.34382E+05	.35365E+05	.36314E+05
1.40	.23663E+05	.25460E+05	.27054E+05	.28497E+05	.29820E+05	.31049E+05	.32201E+05	.33289E+05	.34324E+05	.35315E+05	.36270E+05
1.45	.23619E+05	.25402E+05	.26987E+05	.28424E+05	.29746E+05	.30974E+05	.32128E+05	.33220E+05	.34261E+05	.35261E+05	.36216E+05
1.50	.23569E+05	.25335E+05	.26910E+05	.28342E+05	.29661E+05	.30890E+05	.32047E+05	.33142E+05	.34190E+05	.35196E+05	.36168E+05
1.55	.23511E+05	.25258E+05	.26823E+05	.28249E+05	.29566E+05	.30796E+05	.31956E+05	.33059E+05	.34112E+05	.35123E+05	.36111E+05
1.60	.23445E+05	.25171E+05	.26726E+05	.28146E+05	.29461E+05	.30693E+05	.31856E+05	.32965E+05	.34029E+05	.35036E+05	.36052E+05
1.65	.23370E+05	.25076E+05	.26617E+05	.28031E+05	.29344E+05	.30579E+05	.31743E+05	.32861E+05	.33934E+05	.34980E+05	.35994E+05
1.70	.23285E+05	.24967E+05	.26495E+05	.27903E+05	.29217E+05	.30454E+05	.31626E+05	.32752E+05	.33842E+05	.34895E+05	.35924E+05
1.75	.23190E+05	.24846E+05	.26361E+05	.27763E+05	.29075E+05	.30316E+05	.31499E+05	.32634E+05	.33739E+05	.34814E+05	.35866E+05
1.80	.23083E+05	.24711E+05	.26213E+05	.27608E+05	.28919E+05	.30167E+05	.31362E+05	.32513E+05	.33633E+05	.34736E+05	.35789E+05
1.85	.22964E+05	.24564E+05	.26047E+05	.27439E+05	.28751E+05	.30007E+05	.31213E+05	.32383E+05	.33519E+05	.34619E+05	
1.90	.22830E+05	.24403E+05	.25867E+05	.27252E+05	.28568E+05	.29834E+05	.31057E+05	.32241E+05			
1.95	.22688E+05	.24216E+05	.25668E+05	.27049E+05	.28370E+05	.29647E+05	.30886E+05				
2.00	.22527E+05	.24023E+05	.25450E+05	.26825E+05	.28153E+05						
2.05	.22349E+05	.23804E+05	.25214E+05								
2.10	.22158E+05	.23569E+05									

TABLE IV. ISOTHERMAL COMPRESSIBILITY ($cm^2 \cdot dyne^{-1}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.12143E-07	.10108E-07	.87012E-08	.76651E-08	.68670E-08	.62315E-08	.57122E-08	.52792E-08	.49121E-08	.45955E-08	.43221E-08
.15	.12142E-07	.10107E-07	.87010E-08	.76650E-08	.68670E-08	.62314E-08	.57122E-08	.52792E-08	.49122E-08	.45956E-08	.43221E-08
.20	.12141E-07	.10107E-07	.87008E-08	.76649E-08	.68669E-08	.62314E-08	.57122E-08	.52793E-08	.49122E-08	.45956E-08	.43222E-08
.25	.12140E-07	.10106E-07	.87004E-08	.76647E-08	.68668E-08	.62314E-08	.57122E-08	.52793E-08	.49123E-08	.45957E-08	.43223E-08
.30	.12139E-07	.10105E-07	.87001E-08	.76646E-08	.68668E-08	.62314E-08	.57123E-08	.52794E-08	.49124E-08	.45958E-08	.43224E-08
.35	.12137E-07	.10105E-07	.86997E-08	.76645E-08	.68668E-08	.62316E-08	.57125E-08	.52796E-08	.49126E-08	.45971E-08	.43227E-08
.40	.12134E-07	.10104E-07	.86994E-08	.76645E-08	.68670E-08	.62319E-08	.57128E-08	.52800E-08	.49130E-08	.45975E-08	.43230E-08
.45	.12132E-07	.10103E-07	.86992E-08	.76647E-08	.68674E-08	.62323E-08	.57134E-08	.52805E-08	.49135E-08	.45980E-08	.43236E-08
.50	.12129E-07	.10102E-07	.86993E-08	.76651E-08	.68681E-08	.62331E-08	.57141E-08	.52813E-08	.49143E-08	.45988E-08	.43243E-08
.55	.12127E-07	.10102E-07	.86997E-08	.76659E-08	.68691E-08	.62342E-08	.57153E-08	.52825E-08	.49154E-08	.45998E-08	.43253E-08
.60	.12124E-07	.10102E-07	.87005E-08	.76672E-08	.68705E-08	.62357E-08	.57168E-08	.52840E-08	.49169E-08	.46012E-08	.43267E-08
.65	.12122E-07	.10102E-07	.87020E-08	.76691E-08	.68726E-08	.62378E-08	.57188E-08	.52859E-08	.49188E-08	.46030E-08	.43284E-08
.70	.12121E-07	.10103E-07	.87042E-08	.76717E-08	.68753E-08	.62405E-08	.57215E-08	.52885E-08	.49212E-08	.46053E-08	.43306E-08
.75	.12120E-07	.10105E-07	.87073E-08	.76752E-08	.68789E-08	.62440E-08	.57249E-08	.52917E-08	.49242E-08	.46082E-08	.43333E-08
.80	.12120E-07	.10108E-07	.87115E-08	.76798E-08	.68834E-08	.62484E-08	.57291E-08	.52956E-08	.49280E-08	.46118E-08	.43366E-08
.85	.12121E-07	.10113E-07	.87171E-08	.76856E-08	.68891E-08	.62539E-08	.57342E-08	.53005E-08	.49325E-08	.46161E-08	.43407E-08
.90	.12123E-07	.10119E-07	.87241E-08	.76928E-08	.68961E-08	.62605E-08	.57405E-08	.53064E-08	.49381E-08	.46212E-08	.43456E-08
.95	.12127E-07	.10126E-07	.87329E-08	.77016E-08	.69046E-08	.62686E-08	.57480E-08	.53135E-08	.49447E-08	.46274E-08	.43514E-08
1.00	.12134E-07	.10136E-07	.87438E-08	.77123E-08	.69149E-08	.62782E-08	.57570E-08	.53218E-08	.49526E-08	.46347E-08	.43582E-08
1.05	.12142E-07	.10149E-07	.87570E-08	.77252E-08	.69270E-08	.62895E-08	.57676E-08	.53317E-08	.49617E-08	.46433E-08	.43662E-08
1.10	.12154E-07	.10164E-07	.87728E-08	.77405E-08	.69414E-08	.63029E-08	.57803E-08	.53432E-08	.49724E-08	.46533E-08	.43755E-08

TABLE IV. ISOTHERMAL COMPRESSIBILITY ($cm^2 \cdot dyne^{-1}$) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.12154E-07	.10164E-07	.87728E-08	.77405E-08	.69414E-08	.63029E-08	.57800E-08	.53432E-08	.49724E-08	.46533E-08	.43755E-08
1.15	.12169E-07	.10183E-07	.87916E-08	.77585E-08	.69582E-08	.63185E-08	.57945E-08	.53566E-08	.49848E-08	.46648E-08	.43863E-08
1.20	.12187E-07	.10205E-07	.88138E-08	.77796E-08	.69779E-08	.63367E-08	.58112E-08	.53721E-08	.49991E-08	.46781E-08	.43987E-08
1.25	.12209E-07	.10231E-07	.88398E-08	.78041E-08	.70006E-08	.63577E-08	.58305E-08	.53899E-08	.50156E-08	.46935E-08	.44129E-08
1.30	.12237E-07	.10262E-07	.88700E-08	.78324E-08	.70268E-08	.63818E-08	.58527E-08	.54104E-08	.50345E-08	.47110E-08	.44292E-08
1.35	.12269E-07	.10298E-07	.89050E-08	.78651E-08	.70569E-08	.64094E-08	.58781E-08	.54337E-08	.50561E-08	.47309E-08	.44478E-08
1.40	.12308E-07	.10339E-07	.89453E-08	.79026E-08	.70914E-08	.64410E-08	.59071E-08	.54603E-08	.50806E-08	.47535E-08	.44688E-08
1.45	.12353E-07	.10388E-07	.89916E-08	.79455E-08	.71308E-08	.64770E-08	.59401E-08	.54906E-08	.51085E-08	.47794E-08	.44927E-08
1.50	.12405E-07	.10443E-07	.90446E-08	.79945E-08	.71756E-08	.65180E-08	.59775E-08	.55250E-08	.51401E-08	.48086E-08	.45198E-08
1.55	.12466E-07	.10507E-07	.91051E-08	.80504E-08	.72266E-08	.65645E-08	.60200E-08	.55639E-08	.51759E-08	.48416E-08	.45504E-08
1.60	.12537E-07	.10580E-07	.91742E-08	.81140E-08	.72846E-08	.66173E-08	.60682E-08	.56080E-08	.52165E-08	.48790E-08	.45850E-08
1.65	.12618E-07	.10663E-07	.92528E-08	.81863E-08	.73505E-08	.66773E-08	.61229E-08	.56580E-08	.52624E-08	.49213E-08	.46241E-08
1.70	.12710E-07	.10758E-07	.93424E-08	.82685E-08	.74254E-08	.67454E-08	.61849E-08	.57147E-08	.53143E-08	.49691E-08	.46683E-08
1.75	.12816E-07	.10866E-07	.94445E-08	.83621E-08	.75105E-08	.68227E-08	.62553E-08	.57789E-08	.53732E-08	.50233E-08	.47182E-08
1.80	.12937E-07	.10990E-07	.95608E-08	.84688E-08	.76075E-08	.69107E-08	.63353E-08	.58519E-08	.54400E-08	.50847E-08	.47749E-08
1.85	.13076E-07	.11131E-07	.96937E-08	.85906E-08	.77182E-08	.70111E-08	.64265E-08	.59351E-08	.55161E-08	.51545E-08	
1.90	.13233E-07	.11292E-07	.98457E-08	.87301E-08	.78449E-08	.71260E-08	.65308E-08	.60301E-08			
1.95	.13414E-07	.11477E-07	.10020E-07	.88904E-08	.79905E-08	.72580E-08	.66506E-08				
2.00	.13620E-07	.11689E-07	.10222E-07	.90756E-08	.81588E-08						
2.05	.13856E-07	.11934E-07	.10455E-07								
2.10	.14128E-07	.12219E-07									

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TABLE V. THERMAL EXPANSION COEFFICIENT $(mK)^{-1}$

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.1124E-02	.7208E-03	.5007E-03	.3674E-03	.2808E-03	.2216E-03	.1793E-03	.1480E-03	.1243E-03	.1008E-03	.8764E-04
.15	.3728E-02	.2408E-02	.1679E-02	.1235E-02	.9455E-03	.7467E-03	.6046E-03	.4994E-03	.4195E-03	.3404E-03	.2961E-03
.20	.8644E-02	.5633E-02	.3949E-02	.2912E-02	.2234E-02	.1766E-02	.1431E-02	.1183E-02	.9945E-03	.8074E-03	.7025E-03
.25	.1646E-01	.1083E-01	.7640E-02	.5653E-02	.4346E-02	.3442E-02	.2792E-02	.2310E-02	.1943E-02	.1579E-02	.1374E-02
.30	.2766E-01	.1841E-01	.1306E-01	.9703E-02	.7477E-02	.5932E-02	.4818E-02	.3990E-02	.3357E-02	.2731E-02	.2377E-02
.35	.4265E-01	.2871E-01	.2051E-01	.1530E-01	.1182E-01	.9392E-02	.7638E-02	.6329E-02	.5327E-02	.4336E-02	.3769E-02
.40	.6174E-01	.4205E-01	.3025E-01	.2265E-01	.1754E-01	.1395E-01	.1135E-01	.9383E-02	.7860E-02	.6350E-02	.5479E-02
.45	.8523E-01	.5861E-01	.4242E-01	.3187E-01	.2469E-01	.1960E-01	.1586E-01	.1300E-01	.1074E-01	.8687E-02	.7029E-02
.50	.1130E+00	.7855E-01	.5709E-01	.4284E-01	.3302E-01	.2593E-01	.2057E-01	.1636E-01	.1296E-01	.9296E-02	.6649E-02
.55	.1447E+00	.1014E+00	.7359E-01	.5473E-01	.4143E-01	.3154E-01	.2376E-01	.1727E-01	.1153E-01	.5633E-02	.3989E-03
.60	.1795E+00	.1259E+00	.9042E-01	.6566E-01	.4759E-01	.3355E-01	.2194E-01	.1162E-01	.1832E-02	-.8344E-02	-.1859E-01
.65	.2152E+00	.1498E+00	.1048E+00	.7223E-01	.4741E-01	.2721E-01	.9511E-02	-.7131E-02	-.2372E-01	-.4134E-01	-.6026E-01
.70	.2494E+00	.1692E+00	.1123E+00	.6944E-01	.3511E-01	.5734E-02	-.2110E-01	-.4777E-01	-.7556E-01	-.1046E+00	-.1359E+00
.75	.2778E+00	.1796E+00	.1073E+00	.5061E-01	.3259E-02	-.3918E-01	-.7972E-01	-.1207E+00	-.1644E+00	-.2108E+00	-.2616E+00
.80	.2950E+00	.1746E+00	.8358E-01	.8301E-02	-.5712E-01	-.1169E+00	-.1762E+00	-.2373E+00	-.3028E+00	-.3730E+00	-.4509E+00
.85	.2964E+00	.1526E+00	.3273E-01	-.6563E-01	-.1537E+00	-.2371E+00	-.3219E+00	-.4099E+00	-.5025E+00	-.6040E+00	-.7170E+00
.90	.2735E+00	.1016E+00	-.5009E-01	-.1793E+00	-.2963E+00	-.4104E+00	-.5250E+00	-.6472E+00	-.7771E+00	-.9113E+00	-.1076E+01
.95	.2330E+00	.1324E-01	-.1734E+00	-.3408E+00	-.4935E+00	-.6436E+00	-.7977E+00	-.9613E+00	-.1134E+01	-.1309E+01	-.1530E+01
1.00	.1626E+00	-.1036E+00	-.3435E+00	-.5530E+00	-.7504E+00	-.9464E+00	-.1147E+01	-.1358E+01	-.1584E+01	-.1825E+01	-.2087E+01
1.05	.5347E-01	-.2601E+00	-.5633E+00	-.8310E+00	-.1079E+01	-.1325E+01	-.1578E+01	-.1845E+01	-.2135E+01	-.2440E+01	-.2770E+01
1.10	-.4643E-01	-.4860E+00	-.8425E+00	-.1165E+01	-.1479E+01	-.1787E+01	-.2101E+01	-.2437E+01	-.2791E+01	-.3156E+01	-.3574E+01

α_p

TABLE V. THERMAL EXPANSION COEFFICIENT $(mK)^{-1}$ (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	-.4845E-01	-.4860E+00	-.8425E+00	-.1165E+01	-.1479E+01	-.1787E+01	-.2101E+01	-.2437E+01	-.2791E+01	-.3155E+01	-.3574E+01
1.15	-.2218E+00	-.7358E+00	-.1174E+01	-.1574E+01	-.1964E+01	-.2338E+01	-.2721E+01	-.3134E+01	-.3561E+01	-.4009E+01	-.4513E+01
1.20	-.4201E+00	-.1036E+01	-.1574E+01	-.2062E+01	-.2526E+01	-.2984E+01	-.3454E+01	-.3938E+01	-.4459E+01	-.5012E+01	-.5579E+01
1.25	-.6620E+00	-.1364E+01	-.2042E+01	-.2633E+01	-.3184E+01	-.3738E+01	-.4290E+01	-.4877E+01	-.5494E+01	-.6110E+01	-.6838E+01
1.30	-.9055E+00	-.1817E+01	-.2587E+01	-.3285E+01	-.3945E+01	-.4601E+01	-.5268E+01	-.5943E+01	-.6684E+01	-.7470E+01	-.8230E+01
1.35	-.1144E+01	-.2289E+01	-.3223E+01	-.4041E+01	-.4829E+01	-.5603E+01	-.6373E+01	-.7192E+01	-.8038E+01	-.8897E+01	-.9873E+01
1.40	-.1500E+01	-.2850E+01	-.3929E+01	-.4924E+01	-.5840E+01	-.6748E+01	-.7668E+01	-.8596E+01	-.9585E+01	-.1060E+02	-.1170E+02
1.45	-.1830E+01	-.3526E+01	-.4767E+01	-.5925E+01	-.7026E+01	-.8057E+01	-.9135E+01	-.1023E+02	-.1137E+02	-.1261E+02	-.1371E+02
1.50	-.2333E+01	-.4256E+01	-.5735E+01	-.7105E+01	-.8347E+01	-.9591E+01	-.1085E+02	-.1209E+02	-.1343E+02	-.1479E+02	-.1622E+02
1.55	-.2835E+01	-.5069E+01	-.6866E+01	-.8444E+01	-.9917E+01	-.1136E+02	-.1281E+02	-.1432E+02	-.1582E+02	-.1731E+02	-.1905E+02
1.60	-.3575E+01	-.5983E+01	-.8173E+01	-.1001E+02	-.1175E+02	-.1344E+02	-.1511E+02	-.1685E+02	-.1862E+02	-.2047E+02	-.2237E+02
1.65	-.4308E+01	-.7311E+01	-.9733E+01	-.1188E+02	-.1390E+02	-.1589E+02	-.1788E+02	-.1978E+02	-.2182E+02	-.2408E+02	-.2629E+02
1.70	-.5221E+01	-.8759E+01	-.1158E+02	-.1410E+02	-.1649E+02	-.1880E+02	-.2102E+02	-.2334E+02	-.2581E+02	-.2827E+02	-.3077E+02
1.75	-.6610E+01	-.1040E+02	-.1378E+02	-.1679E+02	-.1953E+02	-.2221E+02	-.2487E+02	-.2756E+02	-.3041E+02	-.3332E+02	-.3626E+02
1.80	-.7976E+01	-.1246E+02	-.1653E+02	-.1994E+02	-.2313E+02	-.2633E+02	-.2951E+02	-.3265E+02	-.3594E+02	-.3938E+02	-.4245E+02
1.85	-.9844E+01	-.1529E+02	-.1972E+02	-.2383E+02	-.2756E+02	-.3130E+02	-.3501E+02	-.3874E+02	-.4244E+02	-.4600E+02	
1.90	-.1200E+02	-.1878E+02	-.2372E+02	-.2845E+02	-.3283E+02	-.3734E+02	-.4170E+02	-.4595E+02			
1.95	-.1559E+02	-.2222E+02	-.2855E+02	-.3418E+02	-.3944E+02	-.4462E+02	-.4967E+02				
2.00	-.1926E+02	-.2765E+02	-.3450E+02	-.4112E+02	-.4733E+02						
2.05	-.2382E+02	-.3371E+02	-.4210E+02								
2.10	-.3010E+02	-.4180E+02									

α_p

TABLE VI. HELMHOLTZ FREE ENERGY OF EXCITATIONS ($ergs \cdot gm^{-1}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	-.1721E+01	-.1327E+01	-.1073E+01	-.8961E+00	-.7666E+00	-.6679E+00	-.5904E+00	-.5279E+00	-.4767E+00	-.4338E+00	-.3976E+00
.15	-.8698E+01	-.6722E+01	-.5442E+01	-.4550E+01	-.3895E+01	-.3396E+01	-.3004E+01	-.2687E+01	-.2423E+01	-.2211E+01	-.2027E+01
.20	-.2737E+02	-.2121E+02	-.1719E+02	-.1439E+02	-.1233E+02	-.1075E+02	-.9512E+01	-.8513E+01	-.7692E+01	-.7005E+01	-.6424E+01
.25	-.6648E+02	-.5165E+02	-.4194E+02	-.3513E+02	-.3012E+02	-.2628E+02	-.2326E+02	-.2082E+02	-.1881E+02	-.1714E+02	-.1572E+02
.30	-.1370E+03	-.1068E+03	-.8688E+02	-.7285E+02	-.6249E+02	-.5456E+02	-.4830E+02	-.4325E+02	-.3909E+02	-.3562E+02	-.3267E+02
.35	-.2523E+03	-.1973E+03	-.1608E+03	-.1350E+03	-.1159E+03	-.1012E+03	-.8964E+02	-.8029E+02	-.7259E+02	-.6615E+02	-.6069E+02
.40	-.4276E+03	-.3356E+03	-.2740E+03	-.2303E+03	-.1979E+03	-.1730E+03	-.1532E+03	-.1373E+03	-.1242E+03	-.1134E+03	-.1040E+03
.45	-.6805E+03	-.5361E+03	-.4389E+03	-.3696E+03	-.3180E+03	-.2784E+03	-.2470E+03	-.2217E+03	-.2009E+03	-.1836E+03	-.1691E+03
.50	-.1032E+04	-.8164E+03	-.6700E+03	-.5653E+03	-.4874E+03	-.4274E+03	-.3801E+03	-.3422E+03	-.3113E+03	-.2859E+03	-.2651E+03
.55	-.1504E+04	-.1196E+04	-.9849E+03	-.8338E+03	-.7215E+03	-.6355E+03	-.5683E+03	-.5152E+03	-.4731E+03	-.4398E+03	-.4142E+03
.60	-.2120E+04	-.1702E+04	-.1410E+04	-.1201E+04	-.1046E+04	-.9297E+03	-.8407E+03	-.7728E+03	-.7220E+03	-.6858E+03	-.6628E+03
.65	-.2944E+04	-.2376E+04	-.1986E+04	-.1709E+04	-.1508E+04	-.1360E+04	-.1252E+04	-.1176E+04	-.1127E+04	-.1103E+04	-.1102E+04
.70	-.4019E+04	-.3284E+04	-.2782E+04	-.2432E+04	-.2184E+04	-.2013E+04	-.1900E+04	-.1835E+04	-.1813E+04	-.1833E+04	-.1893E+04
.75	-.5452E+04	-.4530E+04	-.3909E+04	-.3488E+04	-.3208E+04	-.3034E+04	-.2945E+04	-.2930E+04	-.2983E+04	-.3103E+04	-.3293E+04
.80	-.7392E+04	-.6273E+04	-.5538E+04	-.5065E+04	-.4783E+04	-.4649E+04	-.4637E+04	-.4737E+04	-.4942E+04	-.5255E+04	-.5683E+04
.85	-.1006E+05	-.8748E+04	-.7921E+04	-.7436E+04	-.7205E+04	-.7180E+04	-.7330E+04	-.7649E+04	-.8125E+04	-.8767E+04	-.9589E+04
.90	-.1377E+05	-.1229E+05	-.1141E+05	-.1098E+05	-.1089E+05	-.1108E+05	-.1152E+05	-.1219E+05	-.1311E+05	-.1427E+05	-.1571E+05
.95	-.1895E+05	-.1734E+05	-.1649E+05	-.1621E+05	-.1638E+05	-.1693E+05	-.1783E+05	-.1907E+05	-.2066E+05	-.2259E+05	-.2493E+05
1.00	-.2614E+05	-.2446E+05	-.2375E+05	-.2376E+05	-.2436E+05	-.2548E+05	-.2707E+05	-.2913E+05	-.3167E+05	-.3473E+05	-.3833E+05
1.05	-.3601E+05	-.3439E+05	-.3395E+05	-.3444E+05	-.3571E+05	-.3765E+05	-.4023E+05	-.4344E+05	-.4731E+05	-.5189E+05	-.5722E+05
1.10	-.4944E+05	-.4799E+05	-.4804E+05	-.4925E+05	-.5144E+05	-.5454E+05	-.5847E+05	-.6325E+05	-.6892E+05	-.7552E+05	-.8312E+05

FE

TABLE VI. HELMHOLTZ FREE ENERGY OF EXCITATIONS (ergs·gm^{-1}) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	-.4944E+05	-.4799E+05	-.4804E+05	-.4925E+05	-.5144E+05	-.5454E+05	-.5847E+05	-.6325E+05	-.6892E+05	-.7552E+05	-.8312E+05
1.15	-.6743E+05	-.6635E+05	-.6711E+05	-.6933E+05	-.7282E+05	-.7749E+05	-.8322E+05	-.9006E+05	-.9810E+05	-.1073E+06	-.1179E+06
1.20	-.9117E+05	-.9070E+05	-.9247E+05	-.9610E+05	-.1013E+06	-.1080E+06	-.1161E+06	-.1257E+06	-.1367E+06	-.1494E+06	-.1637E+06
1.25	-.1221E+06	-.1225E+06	-.1257E+06	-.1312E+06	-.1387E+06	-.1480E+06	-.1592E+06	-.1721E+06	-.1870E+06	-.2040E+06	-.2231E+06
1.30	-.1619E+06	-.1636E+06	-.1686E+06	-.1765E+06	-.1868E+06	-.1995E+06	-.2146E+06	-.2319E+06	-.2516E+06	-.2740E+06	-.2991E+06
1.35	-.2125E+06	-.2157E+06	-.2232E+06	-.2342E+06	-.2482E+06	-.2652E+06	-.2851E+06	-.3079E+06	-.3337E+06	-.3623E+06	-.3953E+06
1.40	-.2760E+06	-.2814E+06	-.2920E+06	-.3069E+06	-.3256E+06	-.3480E+06	-.3740E+06	-.4035E+06	-.4369E+06	-.4744E+06	-.5161E+06
1.45	-.3551E+06	-.3633E+06	-.3779E+06	-.3977E+06	-.4224E+06	-.4515E+06	-.4850E+06	-.5231E+06	-.5658E+06	-.6138E+06	-.6668E+06
1.50	-.4526E+06	-.4646E+06	-.4843E+06	-.5104E+06	-.5424E+06	-.5798E+06	-.6230E+06	-.6716E+06	-.7261E+06	-.7869E+06	-.8544E+06
1.55	-.5724E+06	-.5891E+06	-.6152E+06	-.6492E+06	-.6904E+06	-.7384E+06	-.7933E+06	-.8552E+06	-.9246E+06	-.1001E+07	-.1086E+07
1.60	-.7183E+06	-.7413E+06	-.7754E+06	-.8195E+06	-.8721E+06	-.9336E+06	-.1003E+07	-.1082E+07	-.1169E+07	-.1267E+07	-.1374E+07
1.65	-.8952E+06	-.9263E+06	-.9710E+06	-.1028E+07	-.1095E+07	-.1173E+07	-.1262E+07	-.1361E+07	-.1472E+07	-.1594E+07	-.1731E+07
1.70	-.1110E+07	-.1151E+07	-.1209E+07	-.1282E+07	-.1368E+07	-.1467E+07	-.1579E+07	-.1705E+07	-.1845E+07	-.2001E+07	-.2172E+07
1.75	-.1368E+07	-.1423E+07	-.1498E+07	-.1591E+07	-.1701E+07	-.1827E+07	-.1970E+07	-.2130E+07	-.2307E+07	-.2504E+07	-.2722E+07
1.80	-.1680E+07	-.1752E+07	-.1849E+07	-.1969E+07	-.2109E+07	-.2270E+07	-.2451E+07	-.2654E+07	-.2880E+07	-.3130E+07	-.3405E+07
1.85	-.2055E+07	-.2151E+07	-.2277E+07	-.2430E+07	-.2610E+07	-.2814E+07	-.3046E+07	-.3304E+07	-.3593E+07	-.3910E+07	
1.90	-.2508E+07	-.2634E+07	-.2797E+07	-.2994E+07	-.3224E+07	-.3486E+07	-.3783E+07	-.4114E+07			
1.95	-.3055E+07	-.3221E+07	-.3432E+07	-.3687E+07	-.3982E+07	-.4320E+07	-.4700E+07				
2.00	-.3716E+07	-.3936E+07	-.4212E+07	-.4540E+07	-.4922E+07						
2.05	-.4520E+07	-.4809E+07	-.5170E+07								
2.10	-.5500E+07	-.5883E+07									

TABLE VII. ENTROPY (ergs.gm^{-1}.K^{-1})

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.68876E+02	.53168E+02	.43018E+02	.35957E+02	.30779E+02	.26830E+02	.23727E+02	.21227E+02	.19174E+02	.17459E+02	.16007E+02
.15	.23135E+03	.17910E+03	.14514E+03	.12143E+03	.10402E+03	.90717E+02	.80254E+02	.71823E+02	.64893E+02	.59105E+02	.54202E+02
.20	.54487E+03	.42328E+03	.34365E+03	.28783E+03	.24673E+03	.21529E+03	.19053E+03	.17056E+03	.15414E+03	.14041E+03	.12879E+03
.25	.10564E+04	.82385E+03	.67029E+03	.56214E+03	.48226E+03	.42105E+03	.37278E+03	.33381E+03	.30175E+03	.27493E+03	.25220E+03
.30	.18110E+04	.14184E+04	.11567E+04	.97147E+03	.83420E+03	.72831E+03	.64556E+03	.57828E+03	.52288E+03	.47652E+03	.43721E+03
.35	.28523E+04	.22439E+04	.18346E+04	.15433E+04	.13266E+04	.11598E+04	.10280E+04	.92127E+03	.83337E+03	.75982E+03	.69749E+03
.40	.42230E+04	.33378E+04	.27365E+04	.23061E+04	.19849E+04	.17373E+04	.15413E+04	.13829E+04	.12523E+04	.11446E+04	.10536E+04
.45	.59675E+04	.47403E+04	.38997E+04	.32950E+04	.28429E+04	.24947E+04	.22201E+04	.19996E+04	.18205E+04	.16742E+04	.15548E+04
.50	.81434E+04	.65087E+04	.53800E+04	.45664E+04	.39601E+04	.34965E+04	.31363E+04	.28541E+04	.26336E+04	.24647E+04	.23413E+04
.55	.10840E+05	.87388E+04	.72824E+04	.62376E+04	.54689E+04	.48950E+04	.44666E+04	.41528E+04	.39353E+04	.38036E+04	.37537E+04
.60	.14235E+05	.11626E+05	.98254E+04	.85548E+04	.76494E+04	.70113E+04	.65816E+04	.63248E+04	.62234E+04	.62688E+04	.64648E+04
.65	.18654E+05	.15535E+05	.13416E+05	.11975E+05	.11019E+05	.10433E+05	.10149E+05	.10131E+05	.10363E+05	.10848E+05	.11609E+05
.70	.24654E+05	.21077E+05	.18734E+05	.17256E+05	.16421E+05	.16103E+05	.16223E+05	.16749E+05	.17680E+05	.19026E+05	.20809E+05
.75	.33095E+05	.29187E+05	.26800E+05	.25517E+05	.25091E+05	.25377E+05	.26302E+05	.27836E+05	.29985E+05	.32793E+05	.36299E+05
.80	.45180E+05	.41165E+05	.39016E+05	.38274E+05	.38675E+05	.40054E+05	.42328E+05	.45497E+05	.49571E+05	.54627E+05	.60745E+05
.85	.62512E+05	.58692E+05	.57174E+05	.57467E+05	.59227E+05	.62328E+05	.66654E+05	.72274E+05	.79153E+05	.87428E+05	.97236E+05
.90	.87033E+05	.83848E+05	.83456E+05	.85363E+05	.89188E+05	.94770E+05	.10204E+06	.11100E+06	.12173E+06	.13442E+06	.14913E+06
.95	.12108E+06	.11899E+06	.12035E+06	.12458E+06	.13131E+06	.14027E+06	.15148E+06	.16492E+06	.18078E+06	.19906E+06	.22015E+06
1.00	.16728E+06	.16683E+06	.17064E+06	.17803E+06	.18849E+06	.20190E+06	.21815E+06	.23735E+06	.25955E+06	.28504E+06	.31401E+06
1.05	.22844E+06	.23028E+06	.23726E+06	.24875E+06	.26409E+06	.28307E+06	.30563E+06	.33184E+06	.36189E+06	.39603E+06	.43464E+06
1.10	.30775E+06	.31242E+06	.32358E+06	.34005E+06	.36129E+06	.38710E+06	.41729E+06	.45202E+06	.49151E+06	.53594E+06	.58574E+06

TABLE VII. ENTROPY (ergs·gm^{-1}·K^{-1}) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.30775E+06	.31242E+06	.32358E+06	.34005E+06	.36129E+06	.38710E+06	.41729E+06	.45202E+06	.49151E+06	.53594E+06	.58574E+06
1.15	.40839E+06	.41671E+06	.43276E+06	.45531E+06	.48370E+06	.51775E+06	.55696E+06	.60180E+06	.65234E+06	.70884E+06	.77187E+06
1.20	.53375E+06	.54636E+06	.56831E+06	.59815E+06	.63501E+06	.67851E+06	.72847E+06	.78507E+06	.84836E+06	.91903E+06	.99722E+06
1.25	.68769E+06	.70529E+06	.73403E+06	.77247E+06	.81917E+06	.87377E+06	.93615E+06	.10061E+07	.10845E+07	.11711E+07	.12667E+07
1.30	.87344E+06	.89697E+06	.93394E+06	.98208E+06	.10402E+07	.11075E+07	.11842E+07	.12699E+07	.13649E+07	.14704E+07	.15861E+07
1.35	.10957E+07	.11254E+07	.11718E+07	.12313E+07	.13025E+07	.13848E+07	.14777E+07	.15812E+07	.16961E+07	.18222E+07	.19606E+07
1.40	.13581E+07	.13956E+07	.14523E+07	.15248E+07	.16114E+07	.17104E+07	.18223E+07	.19463E+07	.20833E+07	.22335E+07	.23977E+07
1.45	.16653E+07	.17114E+07	.17807E+07	.18681E+07	.19721E+07	.20909E+07	.22239E+07	.23719E+07	.25341E+07	.27122E+07	.29053E+07
1.50	.20221E+07	.20788E+07	.21623E+07	.22673E+07	.23915E+07	.25322E+07	.26909E+07	.28655E+07	.30574E+07	.32671E+07	.34948E+07
1.55	.24351E+07	.25034E+07	.26035E+07	.27288E+07	.28760E+07	.30433E+07	.32302E+07	.34367E+07	.36633E+07	.39089E+07	.41757E+07
1.60	.29098E+07	.29927E+07	.31119E+07	.32610E+07	.34348E+07	.36331E+07	.38533E+07	.40966E+07	.43625E+07	.46519E+07	.49654E+07
1.65	.34531E+07	.35534E+07	.36962E+07	.38728E+07	.40790E+07	.43127E+07	.45734E+07	.48600E+07	.51708E+07	.55102E+07	.58784E+07
1.70	.40754E+07	.41960E+07	.43662E+07	.45758E+07	.48201E+07	.50969E+07	.54039E+07	.57398E+07	.61073E+07	.65066E+07	.69368E+07
1.75	.47845E+07	.49311E+07	.51335E+07	.53831E+07	.56732E+07	.59996E+07	.63622E+07	.67590E+07	.71914E+07	.76608E+07	.81668E+07
1.80	.55934E+07	.57702E+07	.60135E+07	.63113E+07	.66541E+07	.70408E+07	.74696E+07	.79397E+07	.84498E+07	.90030E+07	.95956E+07
1.85	.65161E+07	.67317E+07	.70234E+07	.73776E+07	.77874E+07	.82453E+07	.87550E+07	.93096E+07	.99144E+07	.10563E+08	
1.90	.75684E+07	.78319E+07	.81848E+07	.86078E+07	.90961E+07	.96412E+07	.10248E+08	.10905E+08			
1.95	.87716E+07	.90966E+07	.95203E+07	.10030E+08	.10613E+08	.11266E+08	.11986E+08				
2.00	.10150E+08	.10551E+08	.11066E+08	.11678E+08	.12379E+08						
2.05	.11734E+08	.12227E+08	.12857E+08								
2.10	.13558E+08	.14172E+08									

TABLE VIII. SPECIFIC HEAT AT CONSTANT PRESSURE ($ergs \cdot gm^{-1} \cdot K^{-1}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.20611E+03	.15939E+03	.12908E+03	.10795E+03	.92449E+02	.80612E+02	.71305E+02	.63809E+02	.57648E+02	.52502E+02	.48142E+02
.15	.68983E+03	.53578E+03	.43491E+03	.36421E+03	.31215E+03	.27235E+03	.24099E+03	.21567E+03	.19483E+03	.17739E+03	.16256E+03
.20	.16194E+04	.12643E+04	.10292E+04	.86338E+03	.74084E+03	.64690E+03	.57280E+03	.51296E+03	.46371E+03	.42253E+03	.38761E+03
.25	.31283E+04	.24566E+04	.20063E+04	.16864E+04	.14489E+04	.12662E+04	.11219E+04	.10051E+04	.90894E+03	.82840E+03	.76005E+03
.30	.53446E+04	.42230E+04	.34609E+04	.29154E+04	.25082E+04	.21942E+04	.19453E+04	.17437E+04	.15772E+04	.14374E+04	.13187E+04
.35	.83915E+04	.66728E+04	.54885E+04	.46339E+04	.39929E+04	.34967E+04	.31026E+04	.27831E+04	.25202E+04	.23017E+04	.21167E+04
.40	.12393E+05	.99206E+04	.81985E+04	.69459E+04	.60030E+04	.52741E+04	.46974E+04	.42339E+04	.38576E+04	.35510E+04	.33028E+04
.45	.17531E+05	.14154E+05	.11775E+05	.10041E+05	.87442E+04	.77537E+04	.69908E+04	.64039E+04	.59583E+04	.56376E+04	.54340E+04
.50	.24143E+05	.19749E+05	.16644E+05	.14410E+05	.12786E+05	.11607E+05	.10776E+05	.10237E+05	.99577E+04	.99262E+04	.10150E+05
.55	.33041E+05	.27632E+05	.23877E+05	.21291E+05	.19560E+05	.18498E+05	.17998E+05	.17997E+05	.18494E+05	.19488E+05	.21031E+05
.60	.45998E+05	.39805E+05	.35716E+05	.33213E+05	.31942E+05	.31701E+05	.32371E+05	.33931E+05	.36373E+05	.39790E+05	.44304E+05
.65	.66138E+05	.59756E+05	.56066E+05	.54525E+05	.54766E+05	.56604E+05	.59903E+05	.64685E+05	.71053E+05	.79158E+05	.89055E+05
.70	.98680E+05	.92951E+05	.90857E+05	.91719E+05	.95138E+05	.10043E+06	.10906E+06	.11954E+06	.13257E+06	.14840E+06	.16720E+06
.75	.15044E+06	.14694E+06	.14812E+06	.15331E+06	.16228E+06	.17464E+06	.19042E+06	.20981E+06	.23292E+06	.26029E+06	.29232E+06
.80	.23061E+06	.23102E+06	.23773E+06	.24999E+06	.26710E+06	.28925E+06	.31599E+06	.34834E+06	.38555E+06	.42892E+06	.47803E+06
.85	.34969E+06	.35652E+06	.37112E+06	.39334E+06	.42200E+06	.45736E+06	.49943E+06	.54820E+06	.60474E+06	.66873E+06	.74183E+06
.90	.51970E+06	.53507E+06	.56066E+06	.59571E+06	.64026E+06	.69252E+06	.75423E+06	.82403E+06	.90461E+06	.99398E+06	.10950E+07
.95	.75371E+06	.77947E+06	.81921E+06	.87088E+06	.93346E+06	.10075E+07	.10924E+07	.11894E+07	.12975E+07	.14192E+07	.15536E+07
1.00	.10636E+07	.11030E+07	.11586E+07	.12311E+07	.13170E+07	.14168E+07	.15299E+07	.16571E+07	.17984E+07	.19577E+07	.21323E+07
1.05	.14639E+07	.15172E+07	.15945E+07	.16896E+07	.18025E+07	.19322E+07	.20783E+07	.22409E+07	.24222E+07	.26205E+07	.28367E+07
1.10	.19875E+07	.20384E+07	.21383E+07	.22594E+07	.24023E+07	.25682E+07	.27505E+07	.29553E+07	.31806E+07	.34249E+07	.36935E+07

C_p

TABLE VIII. SPECIFIC HEAT AT CONSTANT PRESSURE (ergs·gm^{-1}·K^{-1}) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.19675E+07	.20384E+07	.21383E+07	.22594E+07	.24023E+07	.25682E+07	.27505E+07	.29553E+07	.31806E+07	.34249E+07	.36935E+07
1.15	.25850E+07	.26767E+07	.28003E+07	.29536E+07	.31331E+07	.33360E+07	.35630E+07	.38144E+07	.40867E+07	.43887E+07	.47145E+07
1.20	.33373E+07	.34482E+07	.35996E+07	.37906E+07	.40096E+07	.42555E+07	.45334E+07	.48338E+07	.51677E+07	.55267E+07	.59172E+07
1.25	.42298E+07	.43670E+07	.45543E+07	.47822E+07	.50471E+07	.53442E+07	.56765E+07	.60398E+07	.64346E+07	.68700E+07	.73375E+07
1.30	.52854E+07	.54425E+07	.56721E+07	.59461E+07	.62619E+07	.66223E+07	.70161E+07	.74522E+07	.79255E+07	.84387E+07	.89925E+07
1.35	.65241E+07	.67110E+07	.69760E+07	.73038E+07	.76871E+07	.81119E+07	.85887E+07	.91032E+07	.96687E+07	.10268E+08	.10923E+08
1.40	.79528E+07	.81801E+07	.84997E+07	.88865E+07	.93462E+07	.98570E+07	.10414E+08	.11036E+08	.11693E+08	.12421E+08	.13181E+08
1.45	.96005E+07	.98786E+07	.10266E+08	.10736E+08	.11280E+08	.11881E+08	.12553E+08	.13287E+08	.14079E+08	.14940E+08	.15857E+08
1.50	.11517E+08	.11848E+08	.12308E+08	.12875E+08	.13519E+08	.14239E+08	.15050E+08	.15920E+08	.16886E+08	.17884E+08	.18983E+08
1.55	.13727E+08	.14130E+08	.14677E+08	.15357E+08	.16118E+08	.17013E+08	.17954E+08	.19014E+08	.20161E+08	.21392E+08	.22712E+08
1.60	.16243E+08	.16754E+08	.17433E+08	.18248E+08	.19189E+08	.20242E+08	.21420E+08	.22699E+08	.24027E+08	.25522E+08	.27147E+08
1.65	.19182E+08	.19795E+08	.20636E+08	.21627E+08	.22784E+08	.24072E+08	.25499E+08	.27015E+08	.28684E+08	.30484E+08	.32394E+08
1.70	.22574E+08	.23357E+08	.24359E+08	.25592E+08	.27013E+08	.28532E+08	.30299E+08	.32155E+08	.34219E+08	.36413E+08	.38751E+08
1.75	.26487E+08	.27462E+08	.28733E+08	.30274E+08	.31978E+08	.33887E+08	.36005E+08	.38353E+08	.40822E+08	.43512E+08	.46324E+08
1.80	.31079E+08	.32308E+08	.33901E+08	.35770E+08	.37914E+08	.40264E+08	.42896E+08	.45718E+08	.48813E+08	.51990E+08	.55549E+08
1.85	.36423E+08	.38012E+08	.40032E+08	.42318E+08	.45003E+08	.47906E+08	.51183E+08	.54622E+08	.58396E+08	.62431E+08	
1.90	.42711E+08	.44772E+08	.47254E+08	.50156E+08	.53460E+08	.57156E+08	.61103E+08	.65403E+08			
1.95	.50162E+08	.52835E+08	.55961E+08	.59605E+08	.63730E+08	.68250E+08	.73192E+08				
2.00	.59023E+08	.62349E+08	.66457E+08	.71059E+08	.76168E+08						
2.05	.69570E+08	.73890E+08	.79101E+08								
2.10	.82327E+08	.88056E+08									

TABLE IX. SPECIFIC HEAT AT CONSTANT VOLUME ($ergs \cdot gm^{-1} \cdot K^{-1}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.20611E+03	.15939E+03	.12908E+03	.10795E+03	.92449E+02	.80612E+02	.71305E+02	.63809E+02	.57683E+02	.52502E+02	.48142E+02
.15	.68983E+03	.53578E+03	.43491E+03	.36421E+03	.31215E+03	.27235E+03	.24099E+03	.21567E+03	.19483E+03	.17739E+03	.16256E+03
.20	.16193E+04	.12643E+04	.10292E+04	.86338E+03	.74084E+03	.64690E+03	.57279E+03	.51296E+03	.46371E+03	.42253E+03	.38761E+03
.25	.31283E+04	.24566E+04	.20062E+04	.16864E+04	.14488E+04	.12662E+04	.11219E+04	.10051E+04	.90894E+03	.82840E+03	.76005E+03
.30	.53445E+04	.42229E+04	.34609E+04	.29153E+04	.25082E+04	.21942E+04	.19453E+04	.17437E+04	.15772E+04	.14374E+04	.13187E+04
.35	.83911E+04	.66726E+04	.54884E+04	.46338E+04	.39928E+04	.34966E+04	.31026E+04	.27831E+04	.25202E+04	.23017E+04	.21167E+04
.40	.12362E+05	.99202E+04	.81982E+04	.69458E+04	.60029E+04	.52741E+04	.46973E+04	.42338E+04	.38576E+04	.35509E+04	.33028E+04
.45	.17529E+05	.14153E+05	.11774E+05	.10041E+05	.87439E+04	.77535E+04	.69907E+04	.64038E+04	.59532E+04	.56375E+04	.54340E+04
.50	.24139E+05	.19747E+05	.16642E+05	.14409E+05	.12736E+05	.11606E+05	.10776E+05	.10236E+05	.99576E+04	.99261E+04	.10150E+05
.55	.33035E+05	.27628E+05	.23874E+05	.21290E+05	.19559E+05	.18490E+05	.17998E+05	.17997E+05	.18494E+05	.19498E+05	.21031E+05
.60	.45987E+05	.39799E+05	.35713E+05	.33211E+05	.31941E+05	.31701E+05	.32371E+05	.33931E+05	.36378E+05	.39790E+05	.44304E+05
.65	.66171E+05	.59746E+05	.56060E+05	.54522E+05	.54765E+05	.56603E+05	.59903E+05	.64685E+05	.71067E+05	.79156E+05	.89052E+05
.70	.96656E+05	.92937E+05	.90851E+05	.91716E+05	.95137E+05	.10093E+06	.10906E+06	.11954E+06	.13256E+06	.14839E+06	.16718E+06
.75	.15040E+06	.14692E+06	.14812E+06	.15331E+06	.16228E+06	.17464E+06	.19041E+06	.20980E+06	.23290E+06	.26025E+06	.29225E+06
.80	.23057E+06	.23101E+06	.23770E+06	.24999E+06	.26710E+06	.28924E+06	.31596E+06	.34829E+06	.38557E+06	.42876E+06	.47861E+06
.85	.34965E+06	.35651E+06	.37112E+06	.39333E+06	.42198E+06	.45731E+06	.49934E+06	.54803E+06	.60448E+06	.66834E+06	.74125E+06
.90	.51956E+06	.53506E+06	.56065E+06	.59569E+06	.64018E+06	.69237E+06	.75396E+06	.82361E+06	.90395E+06	.99303E+06	.10936E+07
.95	.75368E+06	.77947E+06	.81919E+06	.87079E+06	.93325E+06	.10071E+07	.10917E+07	.11884E+07	.12960E+07	.14171E+07	.15553E+07
1.00	.10636E+07	.11030E+07	.11586E+07	.12303E+07	.13165E+07	.14159E+07	.15285E+07	.16550E+07	.17954E+07	.19535E+07	.21265E+07
1.05	.14639E+07	.15171E+07	.15942E+07	.16890E+07	.18014E+07	.19304E+07	.20756E+07	.22368E+07	.24166E+07	.26126E+07	.28231E+07
1.10	.19675E+07	.20382E+07	.21377E+07	.22581E+07	.24002E+07	.25647E+07	.27454E+07	.29479E+07	.31703E+07	.34111E+07	.36743E+07

C_v

TABLE IX. SPECIFIC HEAT AT CONSTANT VOLUME ($ergs \cdot gm^{-1} \cdot K^{-1}$) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.19675E+07	.20382E+07	.21377E+07	.22581E+07	.24002E+07	.25647E+07	.27454E+07	.29479E+07	.31703E+07	.34111E+07	.36749E+07
1.15	.25650E+07	.26763E+07	.27991E+07	.29513E+07	.31291E+07	.33299E+07	.35540E+07	.38017E+07	.40693E+07	.43655E+07	.46836E+07
1.20	.33372E+07	.34474E+07	.35974E+07	.37864E+07	.40027E+07	.42451E+07	.45184E+07	.48130E+07	.51394E+07	.54890E+07	.58690E+07
1.25	.42295E+07	.43655E+07	.45504E+07	.47751E+07	.50358E+07	.53272E+07	.56525E+07	.60067E+07	.63901E+07	.68113E+07	.72609E+07
1.30	.52848E+07	.54397E+07	.56657E+07	.59346E+07	.62438E+07	.65957E+07	.69786E+07	.74013E+07	.78573E+07	.83487E+07	.88776E+07
1.35	.65231E+07	.67064E+07	.69657E+07	.72858E+07	.76591E+07	.80710E+07	.85320E+07	.90262E+07	.95666E+07	.10136E+08	.10752E+08
1.40	.79511E+07	.81728E+07	.84339E+07	.88590E+07	.93039E+07	.97959E+07	.10329E+08	.10923E+08	.11544E+08	.12228E+08	.12933E+08
1.45	.95978E+07	.98670E+07	.10242E+08	.10695E+08	.11217E+08	.11792E+08	.12434E+08	.13122E+08	.13862E+08	.14659E+08	.15507E+08
1.50	.11513E+08	.11831E+08	.12273E+08	.12815E+08	.13428E+08	.14109E+08	.14871E+08	.15683E+08	.16575E+08	.17490E+08	.18486E+08
1.55	.13720E+08	.14104E+08	.14625E+08	.15269E+08	.15986E+08	.16826E+08	.17698E+08	.18673E+08	.19720E+08	.20834E+08	.22002E+08
1.60	.16231E+08	.16718E+08	.17357E+08	.18122E+08	.18999E+08	.19973E+08	.21055E+08	.22215E+08	.23401E+08	.24724E+08	.26145E+08
1.65	.19165E+08	.19740E+08	.20526E+08	.21445E+08	.22513E+08	.23689E+08	.24978E+08	.26336E+08	.27806E+08	.29357E+08	.30982E+08
1.70	.22549E+08	.23276E+08	.24200E+08	.25332E+08	.26624E+08	.28036E+08	.29567E+08	.31192E+08	.32969E+08	.34836E+08	.36760E+08
1.75	.26446E+08	.27346E+08	.28504E+08	.29858E+08	.31424E+08	.33112E+08	.34962E+08	.36988E+08	.39059E+08	.41270E+08	.43542E+08
1.80	.31018E+08	.32138E+08	.33566E+08	.35232E+08	.37126E+08	.39160E+08	.41407E+08	.43775E+08	.46317E+08	.48826E+08	.51643E+08
1.85	.36329E+08	.37753E+08	.39550E+08	.41542E+08	.43871E+08	.46328E+08	.49066E+08	.51858E+08	.54877E+08	.58068E+08	
1.90	.42569E+08	.44377E+08	.46549E+08	.49080E+08	.51835E+08	.54892E+08	.58075E+08	.61483E+08			
1.95	.49919E+08	.52276E+08	.54933E+08	.57983E+08	.61378E+08	.65001E+08	.68874E+08				
2.00	.58649E+08	.61478E+08	.64949E+08	.68706E+08	.72776E+08						
2.05	.68994E+08	.72593E+08	.76856E+08								
2.10	.81403E+08	.86063E+08									

TABLE X. RATIO OF THE SPECIFIC HEATS

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.15	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.20	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.25	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.30	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.35	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.40	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.45	.10001E+01	.10001E+01	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.50	.10002E+01	.10001E+01	.10001E+01	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.55	.10002E+01	.10001E+01	.10001E+01	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.60	.10002E+01	.10002E+01	.10001E+01	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.65	.10003E+01	.10002E+01	.10001E+01	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.70	.10003E+01	.10001E+01	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10001E+01	.10001E+01
.75	.10002E+01	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10001E+01	.10001E+01	.10002E+01	.10002E+01
.80	.10002E+01	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10001E+01	.10001E+01	.10002E+01	.10003E+01	.10005E+01
.85	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10001E+01	.10002E+01	.10003E+01	.10004E+01	.10006E+01	.10008E+01
.90	.10001E+01	.10000E+01	.10000E+01	.10000E+01	.10001E+01	.10002E+01	.10003E+01	.10005E+01	.10007E+01	.10010E+01	.10013E+01
.95	.10000E+01	.10000E+01	.10000E+01	.10001E+01	.10002E+01	.10004E+01	.10006E+01	.10008E+01	.10011E+01	.10015E+01	.10019E+01
1.00	.10000E+01	.10000E+01	.10001E+01	.10002E+01	.10004E+01	.10006E+01	.10009E+01	.10013E+01	.10017E+01	.10022E+01	.10027E+01
1.05	.10000E+01	.10000E+01	.10002E+01	.10004E+01	.10006E+01	.10009E+01	.10013E+01	.10018E+01	.10024E+01	.10030E+01	.10038E+01
1.10	.10000E+01	.10001E+01	.10003E+01	.10005E+01	.10009E+01	.10013E+01	.10019E+01	.10025E+01	.10032E+01	.10040E+01	.10051E+01

C_p/C_v

TABLE X. RATIO OF THE SPECIFIC HEATS (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.10000E+01	.10001E+01	.10003E+01	.10005E+01	.10009E+01	.10013E+01	.10019E+01	.10025E+01	.10032E+01	.10040E+01	.10051E+01
1.15	.10000E+01	.10002E+01	.10004E+01	.10008E+01	.10013E+01	.10018E+01	.10025E+01	.10033E+01	.10043E+01	.10053E+01	.10066E+01
1.20	.10000E+01	.10002E+01	.10006E+01	.10011E+01	.10017E+01	.10025E+01	.10033E+01	.10043E+01	.10055E+01	.10069E+01	.10084E+01
1.25	.10001E+01	.10003E+01	.10008E+01	.10015E+01	.10023E+01	.10032E+01	.10042E+01	.10055E+01	.10070E+01	.10085E+01	.10105E+01
1.30	.10001E+01	.10005E+01	.10011E+01	.10019E+01	.10029E+01	.10040E+01	.10054E+01	.10069E+01	.10087E+01	.10108E+01	.10129E+01
1.35	.10002E+01	.10007E+01	.10015E+01	.10025E+01	.10037E+01	.10051E+01	.10066E+01	.10085E+01	.10107E+01	.10130E+01	.10159E+01
1.40	.10002E+01	.10009E+01	.10019E+01	.10031E+01	.10045E+01	.10062E+01	.10082E+01	.10104E+01	.10130E+01	.10158E+01	.10191E+01
1.45	.10003E+01	.10012E+01	.10023E+01	.10038E+01	.10056E+01	.10076E+01	.10099E+01	.10126E+01	.10156E+01	.10192E+01	.10225E+01
1.50	.10004E+01	.10015E+01	.10029E+01	.10047E+01	.10068E+01	.10092E+01	.10121E+01	.10151E+01	.10187E+01	.10227E+01	.10272E+01
1.55	.10005E+01	.10018E+01	.10036E+01	.10057E+01	.10083E+01	.10112E+01	.10145E+01	.10183E+01	.10224E+01	.10268E+01	.10323E+01
1.60	.10007E+01	.10022E+01	.10044E+01	.10070E+01	.10100E+01	.10134E+01	.10173E+01	.10217E+01	.10267E+01	.10323E+01	.10383E+01
1.65	.10009E+01	.10028E+01	.10054E+01	.10085E+01	.10120E+01	.10162E+01	.10209E+01	.10258E+01	.10315E+01	.10384E+01	.10456E+01
1.70	.10011E+01	.10035E+01	.10066E+01	.10103E+01	.10146E+01	.10195E+01	.10248E+01	.10309E+01	.10379E+01	.10454E+01	.10536E+01
1.75	.10016E+01	.10043E+01	.10080E+01	.10126E+01	.10176E+01	.10234E+01	.10298E+01	.10369E+01	.10451E+01	.10541E+01	.10639E+01
1.80	.10020E+01	.10053E+01	.10100E+01	.10153E+01	.10212E+01	.10282E+01	.10359E+01	.10444E+01	.10539E+01	.10648E+01	.10748E+01
1.85	.10026E+01	.10069E+01	.10122E+01	.10187E+01	.10258E+01	.10341E+01	.10432E+01	.10533E+01	.10641E+01	.10751E+01	
1.90	.10033E+01	.10089E+01	.10151E+01	.10227E+01	.10314E+01	.10413E+01	.10521E+01	.10638E+01			
1.95	.10049E+01	.10107E+01	.10187E+01	.10280E+01	.10383E+01	.10500E+01	.10627E+01				
2.00	.10064E+01	.10142E+01	.10232E+01	.10342E+01	.10466E+01						
2.05	.10084E+01	.10179E+01	.10292E+01								
2.10	.10113E+01	.10232E+01									

C_p/C_v

TABLE XI. PHONON NUMBER DENSITY (number·cm^{-3})

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.19992E+17	.15838E+17	.13102E+17	.11166E+17	.97245E+16	.86100E+16	.77227E+16	.69998E+16	.63994E+16	.58931E+16	.54602E+16
.15	.67547E+17	.53646E+17	.44451E+17	.37927E+17	.33062E+17	.29297E+17	.26297E+17	.23852E+17	.21820E+17	.20105E+17	.18639E+17
.20	.15967E+18	.12713E+18	.10549E+18	.90089E+17	.78586E+17	.69672E+17	.62565E+17	.56766E+17	.51947E+17	.47873E+17	.44397E+17
.25	.31052E+18	.24791E+18	.20602E+18	.17611E+18	.15372E+18	.13635E+18	.12248E+18	.11116E+18	.10175E+18	.93799E+17	.86996E+17
.30	.53383E+18	.42746E+18	.35582E+18	.30447E+18	.26594E+18	.23600E+18	.21207E+18	.19253E+18	.17626E+18	.16252E+18	.15075E+18
.35	.84297E+18	.67712E+18	.56463E+18	.48367E+18	.42277E+18	.37536E+18	.33744E+18	.30642E+18	.28060E+18	.25877E+18	.24007E+18
.40	.12509E+19	.10081E+19	.84222E+18	.72230E+18	.63184E+18	.56129E+18	.50478E+18	.45853E+18	.41999E+18	.38739E+18	.35946E+18
.45	.17705E+19	.14317E+19	.11984E+19	.10290E+19	.90091E+18	.80078E+18	.72047E+18	.65467E+18	.59979E+18	.55335E+18	.51353E+18
.50	.24141E+19	.19589E+19	.16431E+19	.14127E+19	.12379E+19	.11010E+19	.99104E+18	.90083E+18	.82555E+18	.76178E+18	.70710E+18
.55	.31944E+19	.26013E+19	.21865E+19	.18824E+19	.16510E+19	.14694E+19	.13232E+19	.12032E+19	.11030E+19	.10180E+19	.94514E+18
.60	.41237E+19	.33701E+19	.28388E+19	.24475E+19	.21486E+19	.19136E+19	.17241E+19	.15684E+19	.14382E+19	.13277E+19	.12329E+19
.65	.52148E+19	.42772E+19	.36108E+19	.31175E+19	.27396E+19	.24416E+19	.22011E+19	.20031E+19	.18374E+19	.16957E+19	.15758E+19
.70	.64807E+19	.53345E+19	.45136E+19	.39028E+19	.34332E+19	.30621E+19	.27621E+19	.25147E+19	.23074E+19	.21314E+19	.19799E+19
.75	.79348E+19	.65550E+19	.55589E+19	.48140E+19	.42393E+19	.37841E+19	.34153E+19	.31109E+19	.28555E+19	.26383E+19	.24515E+19
.80	.95915E+19	.79521E+19	.67591E+19	.58624E+19	.51684E+19	.46172E+19	.41698E+19	.38000E+19	.34894E+19	.32251E+19	.29974E+19
.85	.11466E+20	.95400E+19	.81276E+19	.70609E+19	.62320E+19	.55721E+19	.50356E+19	.45914E+19	.42179E+19	.38996E+19	.36254E+19
.90	.13574E+20	.11335E+20	.96793E+19	.84224E+19	.74426E+19	.66605E+19	.60234E+19	.54951E+19	.50504E+19	.46710E+19	.43438E+19
.95	.15935E+20	.13353E+20	.11430E+20	.99620E+19	.88141E+19	.78953E+19	.71454E+19	.65226E+19	.59977E+19	.55494E+19	.51624E+19
1.00	.18570E+20	.15615E+20	.13397E+20	.11696E+20	.10362E+20	.92909E+19	.84150E+19	.76866E+19	.70717E+19	.65462E+19	.60919E+19
1.05	.21499E+20	.18140E+20	.15600E+20	.13644E+20	.12103E+20	.10863E+20	.98476E+19	.90016E+19	.82864E+19	.76745E+19	.71450E+19
1.10	.24751E+20	.20953E+20	.18062E+20	.15825E+20	.14056E+20	.12631E+20	.11460E+20	.10484E+20	.96571E+19	.89489E+19	.83355E+19

N_p

TABLE XI. PHONON NUMBER DENSITY (number·cm^{-3}) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.24751E+20	.20953E+20	.18062E+20	.15825E+20	.14056E+20	.12631E+20	.11460E+20	.10484E+20	.96571E+19	.89489E+19	.83355E+19
1.15	.28350E+20	.24079E+20	.20807E+20	.18262E+20	.16244E+20	.14614E+20	.13272E+20	.12151E+20	.11201E+20	.10386E+20	.96797E+19
1.20	.32328E+20	.27549E+20	.23860E+20	.20980E+20	.18690E+20	.16834E+20	.15305E+20	.14025E+20	.12938E+20	.12005E+20	.11196E+20
1.25	.36726E+20	.31394E+20	.27254E+20	.24009E+20	.21420E+20	.19318E+20	.17583E+20	.16127E+20	.14891E+20	.13827E+20	.12903E+20
1.30	.41574E+20	.35648E+20	.31022E+20	.27378E+20	.24464E+20	.22092E+20	.20130E+20	.18483E+20	.17081E+20	.15875E+20	.14825E+20
1.35	.46921E+20	.40352E+20	.35197E+20	.31121E+20	.27852E+20	.25186E+20	.22977E+20	.21120E+20	.19538E+20	.18173E+20	.16944E+20
1.40	.52810E+20	.45550E+20	.39819E+20	.35274E+20	.31620E+20	.28632E+20	.26154E+20	.24067E+20	.22285E+20	.20747E+20	.19406E+20
1.45	.59292E+20	.51283E+20	.44933E+20	.39877E+20	.35803E+20	.32466E+20	.29692E+20	.27354E+20	.25354E+20	.23627E+20	.22116E+20
1.50	.66414E+20	.57605E+20	.50581E+20	.44971E+20	.40440E+20	.36721E+20	.33627E+20	.31012E+20	.28775E+20	.26838E+20	.25142E+20
1.55	.74249E+20	.64565E+20	.56811E+20	.50600E+20	.45569E+20	.41436E+20	.37990E+20	.35073E+20	.32576E+20	.30407E+20	.28506E+20
1.60	.82846E+20	.72224E+20	.63674E+20	.56806E+20	.51232E+20	.46646E+20	.42815E+20	.39569E+20	.36782E+20	.34361E+20	.32233E+20
1.65	.92275E+20	.80637E+20	.71221E+20	.63638E+20	.57472E+20	.52388E+20	.48134E+20	.44525E+20	.41419E+20	.38716E+20	.36336E+20
1.70	.10262E+21	.89858E+20	.79506E+20	.71140E+20	.64324E+20	.58694E+20	.53976E+20	.49962E+20	.46504E+20	.43487E+20	.40820E+20
1.75	.11393E+21	.99960E+20	.88572E+20	.79351E+20	.71817E+20	.65586E+20	.60353E+20	.55893E+20	.52039E+20	.48666E+20	.45679E+20
1.80	.12630E+21	.11100E+21	.98479E+20	.88310E+20	.79983E+20	.73081E+20	.67271E+20	.62311E+20	.58011E+20	.54235E+20	.50874E+20
1.85	.13979E+21	.12304E+21	.10925E+21	.98037E+20	.88829E+20	.81175E+20	.74721E+20	.69187E+20	.64379E+20	.60134E+20	
1.90	.15449E+21	.13612E+21	.12095E+21	.10854E+21	.98337E+20	.89832E+20	.82643E+20	.76459E+20			
1.95	.17047E+21	.15029E+21	.13353E+21	.11979E+21	.10846E+21	.98992E+20	.90952E+20				
2.00	.18775E+21	.16554E+21	.14699E+21	.13173E+21	.11910E+21						
2.05	.20637E+21	.18184E+21	.16125E+21								
2.10	.22631E+21	.19909E+21									

N_p

TABLE XII. ROTON NUMBER DENSITY (number·cm^{-3})

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.77853E-11	.77853E-11	.77853E-11	.77853E-11	.77853E-11	.82570E-11	.10962E-10	.22088E-10	.66007E-10	.23934E-09	.92056E-09
.15	.31916E-02	.79794E-02	.19933E-01	.49718E-01	.12427E+00	.30962E+00	.77172E+00	.19233E+01	.47882E+01	.11934E+02	.29711E+02
.20	.58891E+04	.11719E+05	.23319E+05	.46335E+05	.91965E+05	.18272E+06	.36257E+06	.71938E+06	.14260E+07	.28258E+07	.56043E+07
.25	.34800E+08	.60393E+08	.10473E+09	.18149E+09	.31448E+09	.54405E+09	.94111E+09	.16289E+10	.28182E+10	.48720E+10	.84189E+10
.30	.11575E+11	.18339E+11	.29042E+11	.45869E+11	.72606E+11	.11471E+12	.18117E+12	.28616E+12	.45184E+12	.71309E+12	.11251E+13
.35	.74305E+12	.11020E+13	.16349E+13	.24216E+13	.35865E+13	.53097E+13	.78594E+13	.11627E+14	.17201E+14	.25426E+14	.37611E+14
.40	.17024E+14	.24038E+14	.33932E+14	.47879E+14	.67501E+14	.95130E+14	.13407E+15	.18879E+15	.26609E+15	.37471E+15	.52772E+15
.45	.19605E+15	.26621E+15	.36186E+15	.49138E+15	.66677E+15	.90506E+15	.12277E+16	.16643E+16	.22566E+16	.30595E+16	.41470E+16
.50	.13929E+16	.18346E+16	.24189E+16	.31850E+16	.41930E+16	.55146E+16	.72573E+16	.95511E+16	.12550E+17	.16503E+17	.21701E+17
.55	.69649E+16	.89481E+16	.11496E+17	.14763E+17	.18961E+17	.24330E+17	.31225E+17	.40053E+17	.51387E+17	.65975E+17	.84476E+17
.60	.26765E+17	.33660E+17	.42341E+17	.53256E+17	.66952E+17	.84164E+17	.10579E+18	.13286E+18	.16692E+18	.20958E+18	.26324E+18
.65	.83878E+17	.10370E+18	.12808E+18	.15820E+18	.19541E+18	.24139E+18	.29797E+18	.36781E+18	.45379E+18	.55983E+18	.69005E+18
.70	.22407E+18	.27262E+18	.33178E+18	.40361E+18	.49091E+18	.59726E+18	.72619E+18	.88259E+18	.10731E+19	.13045E+19	.15843E+19
.75	.52693E+18	.63213E+18	.75911E+18	.91142E+18	.10942E+19	.13134E+19	.15764E+19	.18913E+19	.22687E+19	.27219E+19	.32639E+19
.80	.11156E+19	.13230E+19	.15701E+19	.18630E+19	.22117E+19	.26249E+19	.31136E+19	.36936E+19	.43796E+19	.51939E+19	.61584E+19
.85	.21693E+19	.25445E+19	.29883E+19	.35121E+19	.41250E+19	.48465E+19	.56898E+19	.66849E+19	.78464E+19	.92093E+19	.10811E+20
.90	.39248E+19	.45636E+19	.53091E+19	.61824E+19	.71976E+19	.83792E+19	.97536E+19	.11349E+20	.13209E+20	.15365E+20	.17879E+20
.95	.66877E+19	.77098E+19	.88981E+19	.10277E+20	.11874E+20	.13710E+20	.15834E+20	.18280E+20	.21110E+20	.24357E+20	.28113E+20
1.00	.10830E+20	.12391E+20	.14198E+20	.16282E+20	.18667E+20	.21408E+20	.24547E+20	.28147E+20	.32266E+20	.36989E+20	.42393E+20
1.05	.16783E+20	.19077E+20	.21712E+20	.24745E+20	.28202E+20	.32138E+20	.36619E+20	.41719E+20	.47526E+20	.54149E+20	.61681E+20
1.10	.25060E+20	.28302E+20	.32047E+20	.36303E+20	.41133E+20	.46618E+20	.52820E+20	.59846E+20	.67807E+20	.76807E+20	.86996E+20

TABLE XII. ROTON NUMBER DENSITY (number·cm^{-3}) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.25060E+20	.28302E+20	.32047E+20	.36303E+20	.41133E+20	.46618E+20	.52820E+20	.59846E+20	.67807E+20	.76807E+20	.86996E+20
1.15	.36217E+20	.40698E+20	.45832E+20	.51652E+20	.58235E+20	.65688E+20	.74048E+20	.83492E+20	.94129E+20	.10610E+21	.11959E+21
1.20	.50880E+20	.56910E+20	.63795E+20	.71585E+20	.80357E+20	.90218E+20	.10128E+21	.11370E+21	.12761E+21	.14325E+21	.16076E+21
1.25	.69786E+20	.77729E+20	.86766E+20	.96998E+20	.10846E+21	.12129E+21	.13566E+21	.15168E+21	.16964E+21	.18967E+21	.21207E+21
1.30	.93640E+20	.10395E+21	.11566E+21	.12884E+21	.14358E+21	.16002E+21	.17839E+21	.19884E+21	.22158E+21	.24704E+21	.27533E+21
1.35	.12339E+21	.13648E+21	.15144E+21	.16821E+21	.18691E+21	.20778E+21	.23095E+21	.25670E+21	.28537E+21	.31717E+21	.35252E+21
1.40	.15993E+21	.17647E+21	.19527E+21	.21636E+21	.23991E+21	.26600E+21	.29506E+21	.32720E+21	.36285E+21	.40238E+21	.44621E+21
1.45	.20434E+21	.22498E+21	.24851E+21	.27479E+21	.30414E+21	.33667E+21	.37262E+21	.41256E+21	.45661E+21	.50552E+21	.55936E+21
1.50	.25781E+21	.28348E+21	.31265E+21	.34527E+21	.38161E+21	.42168E+21	.46628E+21	.51541E+21	.56975E+21	.62984E+21	.69615E+21
1.55	.32191E+21	.35353E+21	.38851E+21	.42975E+21	.47442E+21	.52338E+21	.57861E+21	.63909E+21	.70599E+21	.77955E+21	.86076E+21
1.60	.39819E+21	.43712E+21	.48127E+21	.53073E+21	.58551E+21	.64639E+21	.71349E+21	.78775E+21	.86971E+21	.96019E+21	.10600E+22
1.65	.48853E+21	.53632E+21	.59057E+21	.65118E+21	.71849E+21	.79306E+21	.87570E+21	.96690E+21	.10671E+22	.11780E+22	.13008E+22
1.70	.59562E+21	.65410E+21	.72056E+21	.79487E+21	.87751E+21	.96925E+21	.10706E+22	.11823E+22	.13060E+22	.14427E+22	.15932E+22
1.75	.72198E+21	.79378E+21	.87509E+21	.96639E+21	.10680E+22	.11806E+22	.13054E+22	.14432E+22	.15956E+22	.17643E+22	.19505E+22
1.80	.87131E+21	.95920E+21	.10592E+22	.11717E+22	.12965E+22	.14353E+22	.15894E+22	.17601E+22	.19488E+22	.21579E+22	.23881E+22
1.85	.10480E+22	.11561E+22	.12792E+22	.14175E+22	.15722E+22	.17437E+22	.19351E+22	.21466E+22	.23819E+22	.26410E+22	
1.90	.12571E+22	.13905E+22	.15429E+22	.17139E+22	.19057E+22	.21189E+22	.23576E+22	.26217E+22			
1.95	.15057E+22	.16714E+22	.18598E+22	.20729E+22	.23118E+22	.25790E+22	.28774E+22				
2.00	.18023E+22	.20086E+22	.22440E+22	.25099E+22	.28098E+22						
2.05	.21579E+22	.24155E+22	.27115E+22								
2.10	.25863E+22	.29111E+22									

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TABLE XIII. NORMAL FLUID DENSITY ($gm \cdot cm^{-3}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.17520E-08	.11947E-08	.87415E-09	.67158E-09	.53470E-09	.43747E-09	.36568E-09	.31101E-09	.26831E-09	.23426E-09	.20663E-09
.15	.87659E-08	.60140E-08	.44145E-08	.33979E-08	.27086E-08	.22178E-08	.18549E-08	.15783E-08	.13621E-08	.11895E-08	.10494E-08
.20	.27314E-07	.18878E-07	.13913E-07	.10734E-07	.85697E-08	.70245E-08	.58795E-08	.50054E-08	.43215E-08	.37754E-08	.33316E-08
.25	.65646E-07	.45749E-07	.33871E-07	.26206E-07	.20959E-07	.17202E-07	.14411E-07	.12277E-07	.10606E-07	.92703E-08	.81850E-08
.30	.13391E-06	.94156E-07	.70066E-07	.54385E-07	.43599E-07	.35852E-07	.30097E-07	.25707E-07	.22294E-07	.19611E-07	.17501E-07
.35	.24423E-06	.17346E-06	.13000E-06	.10157E-06	.82082E-07	.68287E-07	.58382E-07	.51348E-07	.46653E-07	.44093E-07	.43774E-07
.40	.41380E-06	.29938E-06	.22930E-06	.18479E-06	.15646E-06	.13958E-06	.13196E-06	.13296E-06	.14330E-06	.16469E-06	.20036E-06
.45	.68889E-06	.52627E-06	.43511E-06	.38971E-06	.37831E-06	.39696E-06	.44623E-06	.53068E-06	.65903E-06	.84412E-06	.11042E-05
.50	.12443E-05	.10755E-05	.10308E-05	.10309E-05	.12184E-05	.14476E-05	.17859E-05	.22588E-05	.28995E-05	.37634E-05	.49174E-05
.55	.26462E-05	.26610E-05	.29156E-05	.33914E-05	.41037E-05	.50860E-05	.64027E-05	.81331E-05	.10394E-04	.13321E-04	.17117E-04
.60	.63439E-05	.70729E-05	.82974E-05	.10039E-04	.12366E-04	.15396E-04	.19290E-04	.24241E-04	.30540E-04	.38505E-04	.48600E-04
.65	.15343E-04	.17972E-04	.21585E-04	.26321E-04	.32370E-04	.40005E-04	.49538E-04	.61434E-04	.76215E-04	.94579E-04	.11744E-03
.70	.35002E-04	.41672E-04	.50286E-04	.61102E-04	.74528E-04	.91120E-04	.11146E-03	.13635E-03	.16690E-03	.20426E-03	.24972E-03
.75	.73663E-04	.87904E-04	.10568E-03	.12748E-03	.15401E-03	.18620E-03	.22515E-03	.27215E-03	.32836E-03	.39738E-03	.47980E-03
.80	.14296E-03	.17012E-03	.20317E-03	.24294E-03	.29079E-03	.34801E-03	.41621E-03	.49770E-03	.59468E-03	.71046E-03	.84836E-03
.85	.25829E-03	.30552E-03	.36213E-03	.42965E-03	.50935E-03	.60388E-03	.71513E-03	.84719E-03	.10023E-02	.11853E-02	.14014E-02
.90	.43798E-03	.51507E-03	.60582E-03	.71291E-03	.83832E-03	.98522E-03	.11571E-02	.13579E-02	.15932E-02	.18673E-02	.21886E-02
.95	.70366E-03	.82198E-03	.96016E-03	.11214E-02	.13092E-02	.15265E-02	.17792E-02	.20717E-02	.24118E-02	.28042E-02	.32603E-02
1.00	.10793E-02	.12528E-02	.14539E-02	.16868E-02	.19547E-02	.22640E-02	.26200E-02	.30305E-02	.35024E-02	.40462E-02	.46715E-02
1.05	.15902E-02	.18352E-02	.21164E-02	.24409E-02	.28123E-02	.32371E-02	.37230E-02	.42786E-02	.49143E-02	.56428E-02	.64753E-02
1.10	.22643E-02	.25978E-02	.29815E-02	.34185E-02	.39160E-02	.44833E-02	.51275E-02	.58607E-02	.66953E-02	.76433E-02	.87216E-02

TABLE XIII. NORMAL FLUID DENSITY ($gm \cdot cm^{-3}$) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.22643E-02	.25978E-02	.29815E-02	.34185E-02	.39160E-02	.44833E-02	.51275E-02	.58607E-02	.66953E-02	.76433E-02	.87215E-02
1.15	.31293E-02	.35733E-02	.40797E-02	.46542E-02	.53056E-02	.60455E-02	.68792E-02	.78251E-02	.88953E-02	.10105E-01	.11475E-01
1.20	.42140E-02	.47906E-02	.54451E-02	.61854E-02	.70207E-02	.79627E-02	.90238E-02	.10220E-01	.11566E-01	.13095E-01	.14795E-01
1.25	.55524E-02	.62865E-02	.71157E-02	.80532E-02	.91050E-02	.10287E-01	.11614E-01	.13101E-01	.14774E-01	.16649E-01	.18755E-01
1.30	.71713E-02	.80926E-02	.91313E-02	.10297E-01	.11603E-01	.13064E-01	.14701E-01	.16532E-01	.18573E-01	.20877E-01	.23444E-01
1.35	.91129E-02	.10247E-01	.11529E-01	.12965E-01	.14566E-01	.16358E-01	.18354E-01	.20582E-01	.23073E-01	.25849E-01	.28949E-01
1.40	.11410E-01	.12798E-01	.14360E-01	.16107E-01	.18059E-01	.20228E-01	.22650E-01	.25341E-01	.28339E-01	.31679E-01	.35399E-01
1.45	.14105E-01	.15786E-01	.17680E-01	.19791E-01	.22147E-01	.24766E-01	.27671E-01	.30911E-01	.34502E-01	.38506E-01	.42939E-01
1.50	.17243E-01	.19273E-01	.21552E-01	.24092E-01	.26923E-01	.30053E-01	.33548E-01	.37416E-01	.41714E-01	.46491E-01	.51791E-01
1.55	.20893E-01	.23321E-01	.26050E-01	.29093E-01	.32473E-01	.36225E-01	.40392E-01	.45014E-01	.50160E-01	.55345E-01	.62157E-01
1.60	.25119E-01	.28015E-01	.31270E-01	.34906E-01	.38936E-01	.43425E-01	.48394E-01	.53919E-01	.60050E-01	.66857E-01	.74410E-01
1.65	.29970E-01	.33436E-01	.37327E-01	.41661E-01	.46478E-01	.51832E-01	.57790E-01	.64400E-01	.71704E-01	.79845E-01	.88805E-01
1.70	.35589E-01	.39717E-01	.44355E-01	.49529E-01	.55291E-01	.61709E-01	.68836E-01	.76736E-01	.85536E-01	.95323E-01	.10619E+00
1.75	.42064E-01	.46996E-01	.52525E-01	.58721E-01	.65632E-01	.73320E-01	.81938E-01	.91409E-01	.10201E+00	.11384E+00	.12700E+00
1.80	.49552E-01	.55434E-01	.62066E-01	.69508E-01	.77797E-01	.87059E-01	.97406E-01	.10895E+00	.12182E+00	.13619E+00	.15217E+00
1.85	.58234E-01	.65291E-01	.73255E-01	.82204E-01	.92248E-01	.10345E+00	.11604E+00	.13008E+00	.14583E+00	.16336E+00	
1.90	.68327E-01	.76821E-01	.86453E-01	.97286E-01	.10948E+00	.12315E+00	.13857E+00	.15580E+00			
1.95	.80129E-01	.90431E-01	.10210E+00	.11532E+00	.13024E+00	.14707E+00	.16606E+00				
2.00	.94005E-01	.10656E+00	.12085E+00	.13706E+00	.15549E+00						
2.05	.11044E+00	.12581E+00	.14346E+00								
2.10	.13002E+00	.14906E+00									

TABLE XIV. NORMAL FLUID RATIO

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.12072E-07	.80045E-08	.57195E-08	.43042E-08	.33646E-08	.27076E-08	.22293E-08	.18698E-08	.15925E-08	.13738E-08	.11981E-08
.15	.60400E-07	.40294E-07	.28884E-07	.21777E-07	.17044E-07	.13727E-07	.11308E-07	.94890E-08	.80841E-08	.69756E-08	.60849E-08
.20	.18820E-06	.12648E-06	.91031E-07	.68798E-07	.53925E-07	.43476E-07	.35844E-07	.30094E-07	.25649E-07	.22140E-07	.19318E-07
.25	.45232E-06	.30652E-06	.22162E-06	.16796E-06	.13189E-06	.10646E-06	.87855E-07	.73813E-07	.62947E-07	.54363E-07	.47460E-07
.30	.92271E-06	.63086E-06	.45844E-06	.34856E-06	.27435E-06	.22190E-06	.18349E-06	.15456E-06	.13232E-06	.11500E-06	.10148E-06
.35	.16828E-05	.11622E-05	.85059E-06	.65100E-06	.51651E-06	.42265E-06	.35593E-06	.30872E-06	.27690E-06	.25857E-06	.25382E-06
.40	.28513E-05	.20059E-05	.15003E-05	.11844E-05	.98454E-06	.86390E-06	.80448E-06	.79939E-06	.85052E-06	.96582E-06	.11618E-05
.45	.47468E-05	.35262E-05	.28471E-05	.24978E-05	.23807E-05	.24570E-05	.27205E-05	.31907E-05	.39116E-05	.49502E-05	.64025E-05
.50	.85734E-05	.72061E-05	.67449E-05	.69281E-05	.76670E-05	.89597E-05	.10888E-04	.13581E-04	.17210E-04	.22070E-04	.28514E-04
.55	.18234E-04	.17830E-04	.19078E-04	.21738E-04	.25825E-04	.31480E-04	.39036E-04	.48900E-04	.61694E-04	.78122E-04	.99253E-04
.60	.43714E-04	.47393E-04	.54295E-04	.64348E-04	.77819E-04	.95297E-04	.11761E-03	.14575E-03	.18127E-03	.22581E-03	.28130E-03
.65	.10576E-03	.12043E-03	.14125E-03	.16871E-03	.20371E-03	.24762E-03	.30202E-03	.36937E-03	.45236E-03	.55463E-03	.68095E-03
.70	.24120E-03	.27924E-03	.32906E-03	.39166E-03	.46901E-03	.56400E-03	.67953E-03	.81980E-03	.99056E-03	.11978E-02	.14479E-02
.75	.53752E-03	.58904E-03	.69158E-03	.81710E-03	.96921E-03	.11525E-02	.13726E-02	.16362E-02	.19518E-02	.23301E-02	.27818E-02
.80	.98517E-03	.11400E-02	.13295E-02	.15572E-02	.18299E-02	.21539E-02	.25373E-02	.29920E-02	.35291E-02	.41656E-02	.49182E-02
.85	.17800E-02	.20474E-02	.23697E-02	.27539E-02	.32052E-02	.37374E-02	.43593E-02	.50927E-02	.59474E-02	.69490E-02	.81234E-02
.90	.30183E-02	.34516E-02	.39643E-02	.45694E-02	.52750E-02	.60971E-02	.70531E-02	.81618E-02	.94527E-02	.10946E-01	.12685E-01
.95	.48493E-02	.55082E-02	.62829E-02	.71874E-02	.82377E-02	.94461E-02	.10843E-01	.12451E-01	.14308E-01	.16436E-01	.18878E-01
1.00	.74383E-02	.83950E-02	.95135E-02	.10810E-01	.12297E-01	.14008E-01	.15966E-01	.18210E-01	.20774E-01	.23710E-01	.27064E-01
1.05	.10959E-01	.12297E-01	.13848E-01	.15642E-01	.17691E-01	.20026E-01	.22683E-01	.25704E-01	.29142E-01	.33057E-01	.37504E-01
1.10	.15605E-01	.17407E-01	.19506E-01	.21904E-01	.24630E-01	.27736E-01	.31233E-01	.35200E-01	.39692E-01	.44763E-01	.50498E-01

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TABLE XIV. NORMAL FLUID RATIO (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.15605E-01	.17407E-01	.19506E-01	.21904E-01	.24630E-01	.27730E-01	.31233E-01	.35200E-01	.39692E-01	.44753E-01	.50498E-01
1.15	.21565E-01	.23942E-01	.26688E-01	.29816E-01	.33363E-01	.37383E-01	.41892E-01	.46995E-01	.52716E-01	.59158E-01	.66415E-01
1.20	.29040E-01	.32096E-01	.35616E-01	.39619E-01	.44138E-01	.49225E-01	.54934E-01	.61343E-01	.68515E-01	.76573E-01	.85589E-01
1.25	.38262E-01	.42114E-01	.46536E-01	.51571E-01	.57226E-01	.63570E-01	.70675E-01	.78598E-01	.87480E-01	.97376E-01	.10844E+00
1.30	.49416E-01	.54207E-01	.59705E-01	.65923E-01	.72903E-01	.80703E-01	.89421E-01	.99134E-01	.10994E+00	.12203E+00	.13546E+00
1.35	.62792E-01	.68627E-01	.75367E-01	.82975E-01	.91483E-01	.10100E+00	.11158E+00	.12335E+00	.13645E+00	.15098E+00	.16714E+00
1.40	.78615E-01	.85699E-01	.93848E-01	.10305E+00	.11337E+00	.12482E+00	.13760E+00	.15176E+00	.16746E+00	.18488E+00	.20420E+00
1.45	.97171E-01	.10568E+00	.11551E+00	.12656E+00	.13895E+00	.15274E+00	.16799E+00	.18497E+00	.20370E+00	.22452E+00	.24744E+00
1.50	.11878E+00	.12899E+00	.14074E+00	.15398E+00	.16881E+00	.18520E+00	.20350E+00	.22369E+00	.24603E+00	.27073E+00	.29810E+00
1.55	.14390E+00	.15604E+00	.17004E+00	.18584E+00	.20346E+00	.22304E+00	.24477E+00	.26884E+00	.29550E+00	.32485E+00	.35729E+00
1.60	.17292E+00	.18739E+00	.20401E+00	.22281E+00	.24374E+00	.26711E+00	.29294E+00	.32160E+00	.35329E+00	.38834E+00	.42707E+00
1.65	.20635E+00	.22356E+00	.24338E+00	.26572E+00	.29068E+00	.31846E+00	.34936E+00	.38357E+00	.42121E+00	.46303E+00	.50937E+00
1.70	.24498E+00	.26543E+00	.28900E+00	.31561E+00	.34541E+00	.37866E+00	.41554E+00	.45631E+00	.50159E+00	.55173E+00	.60722E+00
1.75	.28948E+00	.31391E+00	.34196E+00	.37379E+00	.40949E+00	.44924E+00	.49350E+00	.54256E+00	.59702E+00	.65752E+00	.72453E+00
1.80	.34091E+00	.37004E+00	.40370E+00	.44193E+00	.48468E+00	.53251E+00	.58591E+00	.64534E+00	.71129E+00	.78472E+00	.86591E+00
1.85	.40050E+00	.43553E+00	.47598E+00	.52193E+00	.57375E+00	.63156E+00	.69648E+00	.76862E+00	.84929E+00	.93861E+00	
1.90	.46972E+00	.51203E+00	.56109E+00	.61671E+00	.67964E+00	.75013E+00	.82961E+00	.91807E+00			
1.95	.55060E+00	.60218E+00	.66166E+00	.72971E+00	.80671E+00	.89357E+00	.99132E+00				
2.00	.64561E+00	.70883E+00	.78194E+00	.86547E+00	.96068E+00						
2.05	.75799E+00	.83582E+00	.92652E+00								
2.10	.89176E+00	.98892E+00									

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TABLE XV. SUPERFLUID DENSITY ($gm \cdot cm^{-3}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.14513E+00	.14925E+00	.15284E+00	.15603E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.15	.14513E+00	.14925E+00	.15284E+00	.15603E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.20	.14513E+00	.14925E+00	.15284E+00	.15603E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.25	.14513E+00	.14925E+00	.15283E+00	.15603E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.30	.14513E+00	.14925E+00	.15283E+00	.15602E+00	.15892E+00	.16157E+00	.16403E+00	.16633E+00	.16849E+00	.17053E+00	.17246E+00
.35	.14513E+00	.14925E+00	.15283E+00	.15602E+00	.15891E+00	.16157E+00	.16403E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.40	.14513E+00	.14925E+00	.15283E+00	.15602E+00	.15891E+00	.16157E+00	.16403E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.45	.14513E+00	.14925E+00	.15283E+00	.15602E+00	.15891E+00	.16156E+00	.16402E+00	.16632E+00	.16848E+00	.17052E+00	.17246E+00
.50	.14512E+00	.14924E+00	.15282E+00	.15602E+00	.15891E+00	.16156E+00	.16402E+00	.16632E+00	.16848E+00	.17052E+00	.17245E+00
.55	.14512E+00	.14924E+00	.15282E+00	.15601E+00	.15890E+00	.16156E+00	.16402E+00	.16631E+00	.16847E+00	.17051E+00	.17244E+00
.60	.14512E+00	.14923E+00	.15281E+00	.15600E+00	.15889E+00	.16155E+00	.16400E+00	.16630E+00	.16845E+00	.17048E+00	.17241E+00
.65	.14510E+00	.14922E+00	.15280E+00	.15598E+00	.15887E+00	.16152E+00	.16397E+00	.16626E+00	.16841E+00	.17043E+00	.17236E+00
.70	.14508E+00	.14919E+00	.15277E+00	.15595E+00	.15883E+00	.16147E+00	.16391E+00	.16619E+00	.16832E+00	.17033E+00	.17222E+00
.75	.14504E+00	.14914E+00	.15271E+00	.15588E+00	.15875E+00	.16138E+00	.16380E+00	.16606E+00	.16817E+00	.17014E+00	.17200E+00
.80	.14497E+00	.14906E+00	.15261E+00	.15577E+00	.15862E+00	.16122E+00	.16362E+00	.16584E+00	.16791E+00	.16984E+00	.17165E+00
.85	.14485E+00	.14892E+00	.15245E+00	.15558E+00	.15841E+00	.16097E+00	.16333E+00	.16551E+00	.16752E+00	.16938E+00	.17111E+00
.90	.14467E+00	.14871E+00	.15221E+00	.15531E+00	.15808E+00	.16060E+00	.16290E+00	.16501E+00	.16695E+00	.16872E+00	.17035E+00
.95	.14440E+00	.14841E+00	.15186E+00	.15491E+00	.15762E+00	.16008E+00	.16230E+00	.16432E+00	.16615E+00	.16781E+00	.16931E+00
1.00	.14403E+00	.14798E+00	.15137E+00	.15436E+00	.15699E+00	.15936E+00	.16148E+00	.16339E+00	.16509E+00	.16661E+00	.16794E+00
1.05	.14351E+00	.14740E+00	.15072E+00	.15361E+00	.15616E+00	.15841E+00	.16041E+00	.16217E+00	.16372E+00	.16505E+00	.16618E+00
1.10	.14284E+00	.14664E+00	.14987E+00	.15268E+00	.15508E+00	.15720E+00	.15904E+00	.16063E+00	.16199E+00	.16311E+00	.16399E+00

TABLE XV. SUPERFLUID DENSITY ($gm \cdot cm^{-3}$) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.14284E+00	.14664E+00	.14987E+00	.15265E+00	.15508E+00	.15720E+00	.15904E+00	.16063E+00	.16199E+00	.16311E+00	.16399E+00
1.15	.14198E+00	.14568E+00	.14879E+00	.15144E+00	.15372E+00	.15567E+00	.15733E+00	.15872E+00	.15984E+00	.16071E+00	.16131E+00
1.20	.14090E+00	.14447E+00	.14744E+00	.14994E+00	.15204E+00	.15380E+00	.15524E+00	.15639E+00	.15724E+00	.15780E+00	.15807E+00
1.25	.13956E+00	.14299E+00	.14579E+00	.14810E+00	.15000E+00	.15153E+00	.15272E+00	.15358E+00	.15412E+00	.15433E+00	.15420E+00
1.30	.13795E+00	.14120E+00	.14381E+00	.14590E+00	.14756E+00	.14882E+00	.14971E+00	.15023E+00	.15041E+00	.15021E+00	.14963E+00
1.35	.13602E+00	.13907E+00	.14145E+00	.14328E+00	.14466E+00	.14560E+00	.14614E+00	.14628E+00	.14602E+00	.14535E+00	.14425E+00
1.40	.13373E+00	.13654E+00	.13866E+00	.14020E+00	.14124E+00	.14182E+00	.14195E+00	.14164E+00	.14089E+00	.13967E+00	.13796E+00
1.45	.13105E+00	.13358E+00	.13539E+00	.13659E+00	.13724E+00	.13739E+00	.13705E+00	.13621E+00	.13487E+00	.13300E+00	.13059E+00
1.50	.12792E+00	.13014E+00	.13158E+00	.13237E+00	.13256E+00	.13222E+00	.13131E+00	.12986E+00	.12783E+00	.12520E+00	.12194E+00
1.55	.12429E+00	.12613E+00	.12715E+00	.12746E+00	.12713E+00	.12619E+00	.12463E+00	.12244E+00	.11959E+00	.11607E+00	.11181E+00
1.60	.12010E+00	.12149E+00	.12201E+00	.12176E+00	.12080E+00	.11915E+00	.11681E+00	.11374E+00	.10992E+00	.10530E+00	.99824E-01
1.65	.11527E+00	.11613E+00	.11604E+00	.11513E+00	.11342E+00	.11093E+00	.10762E+00	.10350E+00	.98530E-01	.92596E-01	.85633E-01
1.70	.10968E+00	.10992E+00	.10912E+00	.10740E+00	.10478E+00	.10126E+00	.96819E-01	.91432E-01	.84995E-01	.77436E-01	.68692E-01
1.75	.10324E+00	.10272E+00	.10107E+00	.98314E-01	.94646E-01	.89890E-01	.84044E-01	.77068E-01	.68859E-01	.59296E-01	.48266E-01
1.80	.95801E-01	.94371E-01	.91076E-01	.87775E-01	.82715E-01	.76428E-01	.68843E-01	.59878E-01	.49446E-01	.37353E-01	.23505E-01
1.85	.87169E-01	.84620E-01	.80648E-01	.75257E-01	.68533E-01	.60353E-01	.50569E-01	.39158E-01	.25877E-01	.10084E-01	
1.90	.77135E-01	.73211E-01	.67632E-01	.60464E-01	.51606E-01	.41021E-01	.28461E-01	.13903E-01			
1.95	.65401E-01	.59741E-01	.52207E-01	.42716E-01	.31206E-01	.17517E-01	.14533E-02				
2.00	.51602E-01	.43773E-01	.33702E-01	.21305E-01	.63647E-02						
2.05	.35261E-01	.24711E-01	.11377E-01								
2.10	.15781E-01	.16703E-02									

TABLE XVI. SUPERFLUID RATIO

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.15	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.20	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.25	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.30	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.35	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.40	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01
.45	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.99999E+00
.50	.99999E+00	.99999E+00	.99999E+00	.99999E+00	.99999E+00	.99999E+00	.99999E+00	.99999E+00	.99998E+00	.99998E+00	.99997E+00
.55	.99998E+00	.99998E+00	.99998E+00	.99998E+00	.99997E+00	.99997E+00	.99996E+00	.99995E+00	.99994E+00	.99992E+00	.99990E+00
.60	.99995E+00	.99995E+00	.99995E+00	.99994E+00	.99992E+00	.99990E+00	.99988E+00	.99985E+00	.99982E+00	.99977E+00	.99972E+00
.65	.99989E+00	.99988E+00	.99986E+00	.99983E+00	.99980E+00	.99975E+00	.99970E+00	.99963E+00	.99955E+00	.99945E+00	.99932E+00
.70	.99976E+00	.99972E+00	.99967E+00	.99961E+00	.99953E+00	.99944E+00	.99932E+00	.99918E+00	.99901E+00	.99880E+00	.99855E+00
.75	.99949E+00	.99941E+00	.99931E+00	.99918E+00	.99903E+00	.99885E+00	.99863E+00	.99836E+00	.99805E+00	.99767E+00	.99722E+00
.80	.99901E+00	.99886E+00	.99867E+00	.99844E+00	.99817E+00	.99785E+00	.99746E+00	.99701E+00	.99647E+00	.99583E+00	.99508E+00
.85	.99822E+00	.99795E+00	.99763E+00	.99725E+00	.99679E+00	.99626E+00	.99564E+00	.99491E+00	.99405E+00	.99305E+00	.99188E+00
.90	.99693E+00	.99655E+00	.99604E+00	.99543E+00	.99472E+00	.99390E+00	.99295E+00	.99164E+00	.99055E+00	.98905E+00	.98732E+00
.95	.99515E+00	.99449E+00	.99372E+00	.99281E+00	.99176E+00	.99055E+00	.98916E+00	.98755E+00	.98569E+00	.98356E+00	.98111E+00
1.00	.99253E+00	.99161E+00	.99049E+00	.98919E+00	.98770E+00	.98599E+00	.98403E+00	.98179E+00	.97923E+00	.97629E+00	.97294E+00
1.05	.98904E+00	.98770E+00	.98615E+00	.98436E+00	.98231E+00	.97997E+00	.97732E+00	.97430E+00	.97086E+00	.96694E+00	.96250E+00
1.10	.98440E+00	.98259E+00	.98049E+00	.97810E+00	.97537E+00	.97227E+00	.96877E+00	.96480E+00	.96031E+00	.95524E+00	.94950E+00

TABLE XVI. SUPERFLUID RATIO (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.98440E+00	.98259E+00	.98049E+00	.97810E+00	.97537E+00	.97227E+00	.96877E+00	.96480E+00	.96031E+00	.95524E+00	.94950E+00
1.15	.97843E+00	.97606E+00	.97331E+00	.97018E+00	.96664E+00	.96262E+00	.95811E+00	.95302E+00	.94723E+00	.94084E+00	.93359E+00
1.20	.97096E+00	.96790E+00	.96438E+00	.96038E+00	.95586E+00	.95078E+00	.94507E+00	.93866E+00	.93149E+00	.92343E+00	.91441E+00
1.25	.96174E+00	.95789E+00	.95346E+00	.94843E+00	.94277E+00	.93643E+00	.92933E+00	.92140E+00	.91252E+00	.90262E+00	.89156E+00
1.30	.95058E+00	.94579E+00	.94029E+00	.93408E+00	.92710E+00	.91930E+00	.91058E+00	.90087E+00	.89006E+00	.87797E+00	.86454E+00
1.35	.93721E+00	.93137E+00	.92463E+00	.91702E+00	.90852E+00	.89900E+00	.88842E+00	.87665E+00	.86355E+00	.84902E+00	.83286E+00
1.40	.92139E+00	.91430E+00	.90615E+00	.89695E+00	.88663E+00	.87518E+00	.86240E+00	.84824E+00	.83254E+00	.81512E+00	.79580E+00
1.45	.90283E+00	.89432E+00	.88449E+00	.87344E+00	.86105E+00	.84726E+00	.83201E+00	.81503E+00	.79630E+00	.77548E+00	.75256E+00
1.50	.88122E+00	.87101E+00	.85926E+00	.84602E+00	.83119E+00	.81490E+00	.79650E+00	.77632E+00	.75397E+00	.72922E+00	.70190E+00
1.55	.85610E+00	.84396E+00	.82996E+00	.81416E+00	.79654E+00	.77696E+00	.75523E+00	.73116E+00	.70450E+00	.67515E+00	.64271E+00
1.60	.82709E+00	.81261E+00	.79599E+00	.77719E+00	.75626E+00	.73289E+00	.70706E+00	.67840E+00	.64671E+00	.61166E+00	.57293E+00
1.65	.79365E+00	.77644E+00	.75662E+00	.73423E+00	.70932E+00	.68154E+00	.65064E+00	.61643E+00	.57879E+00	.53697E+00	.49063E+00
1.70	.75502E+00	.73457E+00	.71100E+00	.68439E+00	.65459E+00	.62134E+00	.58446E+00	.54369E+00	.49841E+00	.44822E+00	.39278E+00
1.75	.71052E+00	.68609E+00	.65804E+00	.62621E+00	.59051E+00	.55076E+00	.50650E+00	.45744E+00	.40293E+00	.34248E+00	.27547E+00
1.80	.65909E+00	.62996E+00	.59630E+00	.55807E+00	.51532E+00	.46749E+00	.41409E+00	.35466E+00	.28871E+00	.21528E+00	.13409E+00
1.85	.59950E+00	.56447E+00	.52402E+00	.47807E+00	.42625E+00	.36844E+00	.30352E+00	.23138E+00	.15071E+00	.61390E-01	
1.90	.53028E+00	.48797E+00	.43891E+00	.38329E+00	.32036E+00	.24987E+00	.17039E+00	.81927E-01			
1.95	.44940E+00	.39782E+00	.33834E+00	.27029E+00	.19329E+00	.10643E+00	.86762E-02				
2.00	.35439E+00	.29117E+00	.21806E+00	.13453E+00	.39324E-01						
2.05	.24201E+00	.16418E+00	.73476E-01								
2.10	.10824E+00	.11081E-01									

TABLE XVII. VELOCITY OF SECOND SOUND ($cm \cdot sec^{-1}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.13808E+05	.14885E+05	.15832E+05	.16681E+05	.17452E+05	.18161E+05	.18819E+05	.19434E+05	.20012E+05	.20558E+05	.21077E+05
.15	.13881E+05	.14929E+05	.15860E+05	.16700E+05	.17465E+05	.18171E+05	.18829E+05	.19445E+05	.20025E+05	.20578E+05	.21107E+05
.20	.13958E+05	.14969E+05	.15878E+05	.16702E+05	.17457E+05	.18155E+05	.18805E+05	.19414E+05	.19988E+05	.20531E+05	.21048E+05
.25	.14041E+05	.15011E+05	.15894E+05	.16701E+05	.17444E+05	.18132E+05	.18774E+05	.19377E+05	.19946E+05	.20485E+05	.20996E+05
.30	.14125E+05	.15051E+05	.15905E+05	.16692E+05	.17418E+05	.18091E+05	.18715E+05	.19294E+05	.19825E+05	.20300E+05	.20701E+05
.35	.14200E+05	.15075E+05	.15885E+05	.16623E+05	.17282E+05	.17849E+05	.18300E+05	.18594E+05	.18663E+05	.18426E+05	.17802E+05
.40	.14208E+05	.14965E+05	.15605E+05	.16080E+05	.16329E+05	.16278E+05	.15858E+05	.15034E+05	.13833E+05	.12362E+05	.10757E+05
.45	.13877E+05	.14234E+05	.14283E+05	.13957E+05	.13218E+05	.12125E+05	.10799E+05	.93840E+04	.79995E+04	.67227E+04	.55916E+04
.50	.12656E+05	.12200E+05	.11354E+05	.10219E+05	.89433E+04	.76657E+04	.64742E+04	.54126E+04	.44934E+04	.37235E+04	.30773E+04
.55	.10357E+05	.92330E+04	.80019E+04	.67997E+04	.57066E+04	.47570E+04	.39519E+04	.32829E+04	.27323E+04	.22861E+04	.19267E+04
.60	.77757E+04	.65565E+04	.54652E+04	.45327E+04	.37580E+04	.31245E+04	.26127E+04	.22029E+04	.18771E+04	.16199E+04	.14170E+04
.65	.56839E+04	.46687E+04	.38434E+04	.31830E+04	.26595E+04	.22466E+04	.19234E+04	.16707E+04	.14733E+04	.13195E+04	.12006E+04
.70	.42274E+04	.34609E+04	.28661E+04	.24084E+04	.20563E+04	.17852E+04	.15761E+04	.14150E+04	.12902E+04	.11933E+04	.11131E+04
.75	.32790E+04	.27161E+04	.22923E+04	.19736E+04	.17318E+04	.15482E+04	.14080E+04	.13000E+04	.12167E+04	.11518E+04	.11009E+04
.80	.26797E+04	.22675E+04	.19618E+04	.17337E+04	.15633E+04	.14337E+04	.13354E+04	.12586E+04	.11997E+04	.11535E+04	.11168E+04
.85	.23080E+04	.20008E+04	.17754E+04	.16076E+04	.14824E+04	.13873E+04	.13141E+04	.12579E+04	.12132E+04	.11783E+04	.11501E+04
.90	.20816E+04	.18478E+04	.16760E+04	.15486E+04	.14521E+04	.13794E+04	.13226E+04	.12788E+04	.12434E+04	.12159E+04	.11932E+04
.95	.19474E+04	.17651E+04	.16299E+04	.15292E+04	.14535E+04	.13948E+04	.13493E+04	.13127E+04	.12840E+04	.12599E+04	.12405E+04
1.00	.18737E+04	.17265E+04	.16176E+04	.15349E+04	.14720E+04	.14231E+04	.13847E+04	.13538E+04	.13288E+04	.13072E+04	.12893E+04
1.05	.18380E+04	.17169E+04	.16248E+04	.15556E+04	.15020E+04	.14597E+04	.14259E+04	.13985E+04	.13752E+04	.13560E+04	.13391E+04
1.10	.18277E+04	.17243E+04	.16455E+04	.15856E+04	.15385E+04	.15001E+04	.14697E+04	.14438E+04	.14218E+04	.14031E+04	.13861E+04

TABLE XVII. VELOCITY OF SECOND SOUND ($cm \cdot sec^{-1}$) (continued)

Temp. (K)	Pressure (atm)										
	0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.18277E+04	.17243E+04	.16455E+04	.15856E+04	.15385E+04	.15001E+04	.14697E+04	.14438E+04	.14218E+04	.14031E+04	.13861E+04
1.15	.18348E+04	.17440E+04	.16748E+04	.16206E+04	.15774E+04	.15426E+04	.15132E+04	.14882E+04	.14669E+04	.14470E+04	.14293E+04
1.20	.18507E+04	.17700E+04	.17075E+04	.16570E+04	.16166E+04	.15835E+04	.15545E+04	.15301E+04	.15074E+04	.14871E+04	.14679E+04
1.25	.18743E+04	.17996E+04	.17407E+04	.16936E+04	.16547E+04	.16219E+04	.15930E+04	.15672E+04	.15438E+04	.15209E+04	.14992E+04
1.30	.18999E+04	.18311E+04	.17744E+04	.17285E+04	.16901E+04	.16562E+04	.16266E+04	.15989E+04	.15729E+04	.15480E+04	.15235E+04
1.35	.19255E+04	.18595E+04	.18055E+04	.17599E+04	.17201E+04	.16855E+04	.16531E+04	.16234E+04	.15944E+04	.15663E+04	.15386E+04
1.40	.19507E+04	.18858E+04	.18315E+04	.17856E+04	.17441E+04	.17068E+04	.16727E+04	.16389E+04	.16072E+04	.15749E+04	.15426E+04
1.45	.19727E+04	.19073E+04	.18519E+04	.18036E+04	.17600E+04	.17204E+04	.16817E+04	.16448E+04	.16079E+04	.15703E+04	.15321E+04
1.50	.19877E+04	.19220E+04	.18651E+04	.18140E+04	.17677E+04	.17239E+04	.16807E+04	.16386E+04	.15952E+04	.15526E+04	.15072E+04
1.55	.19958E+04	.19283E+04	.18692E+04	.18146E+04	.17646E+04	.17144E+04	.16671E+04	.16182E+04	.15684E+04	.15169E+04	.14630E+04
1.60	.19973E+04	.19259E+04	.18622E+04	.18034E+04	.17471E+04	.16920E+04	.16362E+04	.15797E+04	.15231E+04	.14618E+04	.13982E+04
1.65	.19862E+04	.19119E+04	.18428E+04	.17783E+04	.17147E+04	.16518E+04	.15876E+04	.15226E+04	.14533E+04	.13805E+04	.13020E+04
1.70	.19633E+04	.18832E+04	.18092E+04	.17366E+04	.16646E+04	.15923E+04	.15180E+04	.14406E+04	.13570E+04	.12670E+04	.11685E+04
1.75	.19267E+04	.18403E+04	.17574E+04	.16752E+04	.15937E+04	.15096E+04	.14210E+04	.13257E+04	.12233E+04	.11088E+04	.97877E+03
1.80	.18717E+04	.17771E+04	.16841E+04	.15910E+04	.14950E+04	.13948E+04	.12864E+04	.11679E+04	.10338E+04	.87742E+03	.67973E+03
1.85	.17967E+04	.16907E+04	.15842E+04	.14763E+04	.13609E+04	.12376E+04	.10988E+04	.94002E+03	.74336E+03	.46502E+03	
1.90	.16961E+04	.15750E+04	.14516E+04	.13202E+04	.11773E+04	.10145E+04	.81395E+03	.55525E+03			
1.95	.15625E+04	.14204E+04	.12708E+04	.11041E+04	.90875E+03	.65721E+03	.19302E+03				
2.00	.13843E+04	.12112E+04	.10138E+04	.77243E+03	.40583E+03						
2.05	.11381E+04	.90263E+03	.58288E+03								
2.10	.75438E+03	.23167E+03									

TABLE XVIII. ENERGY OF FIRST MAXIMUM AT 1.1 $\mathring{A}^{-1}$ (K)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.13816E+02	.14197E+02	.14438E+02	.14592E+02	.14691E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.15	.13816E+02	.14197E+02	.14438E+02	.14592E+02	.14691E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.20	.13816E+02	.14197E+02	.14438E+02	.14592E+02	.14691E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.25	.13816E+02	.14197E+02	.14438E+02	.14592E+02	.14691E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.30	.13816E+02	.14197E+02	.14437E+02	.14592E+02	.14691E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.35	.13816E+02	.14196E+02	.14437E+02	.14592E+02	.14691E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.40	.13816E+02	.14196E+02	.14437E+02	.14592E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.45	.13816E+02	.14196E+02	.14437E+02	.14592E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.50	.13815E+02	.14196E+02	.14437E+02	.14592E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.55	.13815E+02	.14196E+02	.14437E+02	.14592E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.60	.13815E+02	.14196E+02	.14437E+02	.14591E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.65	.13815E+02	.14195E+02	.14437E+02	.14591E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.70	.13815E+02	.14195E+02	.14437E+02	.14591E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.75	.13814E+02	.14195E+02	.14436E+02	.14591E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.80	.13814E+02	.14195E+02	.14436E+02	.14591E+02	.14690E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.85	.13814E+02	.14195E+02	.14436E+02	.14592E+02	.14691E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.90	.13814E+02	.14195E+02	.14437E+02	.14592E+02	.14691E+02	.14752E+02	.14789E+02	.14809E+02	.14819E+02	.14822E+02	.14822E+02
.95	.13813E+02	.14195E+02	.14437E+02	.14592E+02	.14691E+02	.14753E+02	.14789E+02	.14810E+02	.14819E+02	.14822E+02	.14822E+02
1.00	.13813E+02	.14195E+02	.14437E+02	.14593E+02	.14691E+02	.14753E+02	.14790E+02	.14810E+02	.14819E+02	.14822E+02	.14822E+02
1.05	.13813E+02	.14195E+02	.14438E+02	.14593E+02	.14692E+02	.14754E+02	.14790E+02	.14810E+02	.14819E+02	.14822E+02	.14822E+02
1.10	.13813E+02	.14196E+02	.14438E+02	.14594E+02	.14693E+02	.14754E+02	.14790E+02	.14810E+02	.14819E+02	.14822E+02	.14822E+02

$\varepsilon_{max}/$

TABLE XVIII. ENERGY OF FIRST MAXIMUM AT 1.1 $\mathring{A}^{-1}$ (K) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.13813E+02	.14196E+02	.14438E+02	.14594E+02	.14693E+02	.14756E+02	.14790E+02	.14810E+02	.14819E+02	.14822E+02	.14822E+02
1.15	.13813E+02	.14196E+02	.14439E+02	.14595E+02	.14694E+02	.14755E+02	.14791E+02	.14810E+02	.14819E+02	.14822E+02	.14821E+02
1.20	.13814E+02	.14197E+02	.14440E+02	.14596E+02	.14695E+02	.14756E+02	.14792E+02	.14811E+02	.14820E+02	.14822E+02	.14821E+02
1.25	.13814E+02	.14198E+02	.14442E+02	.14597E+02	.14696E+02	.14757E+02	.14792E+02	.14811E+02	.14820E+02	.14822E+02	.14821E+02
1.30	.13815E+02	.14200E+02	.14443E+02	.14599E+02	.14697E+02	.14758E+02	.14793E+02	.14812E+02	.14820E+02	.14822E+02	.14821E+02
1.35	.13816E+02	.14201E+02	.14445E+02	.14601E+02	.14699E+02	.14759E+02	.14794E+02	.14812E+02	.14820E+02	.14822E+02	.14821E+02
1.40	.13817E+02	.14203E+02	.14448E+02	.14603E+02	.14701E+02	.14761E+02	.14795E+02	.14813E+02	.14820E+02	.14822E+02	.14821E+02
1.45	.13818E+02	.14206E+02	.14451E+02	.14606E+02	.14703E+02	.14762E+02	.14796E+02	.14814E+02	.14821E+02	.14822E+02	.14821E+02
1.50	.13820E+02	.14209E+02	.14454E+02	.14609E+02	.14706E+02	.14764E+02	.14798E+02	.14814E+02	.14821E+02	.14822E+02	.14821E+02
1.55	.13822E+02	.14212E+02	.14458E+02	.14613E+02	.14709E+02	.14767E+02	.14799E+02	.14815E+02	.14821E+02	.14822E+02	.14821E+02
1.60	.13825E+02	.14216E+02	.14462E+02	.14617E+02	.14712E+02	.14769E+02	.14801E+02	.14816E+02	.14822E+02	.14822E+02	.14820E+02
1.65	.13827E+02	.14221E+02	.14467E+02	.14621E+02	.14716E+02	.14772E+02	.14802E+02	.14817E+02	.14822E+02	.14822E+02	.14820E+02
1.70	.13831E+02	.14226E+02	.14473E+02	.14627E+02	.14720E+02	.14775E+02	.14804E+02	.14818E+02	.14822E+02	.14821E+02	.14820E+02
1.75	.13835E+02	.14232E+02	.14479E+02	.14633E+02	.14725E+02	.14779E+02	.14806E+02	.14819E+02	.14822E+02	.14821E+02	.14820E+02
1.80	.13840E+02	.14239E+02	.14487E+02	.14639E+02	.14731E+02	.14782E+02	.14809E+02	.14820E+02	.14822E+02	.14821E+02	.14820E+02
1.85	.13845E+02	.14247E+02	.14495E+02	.14647E+02	.14736E+02	.14786E+02	.14811E+02	.14820E+02	.14822E+02	.14821E+02	
1.90	.13851E+02	.14256E+02	.14505E+02	.14655E+02	.14743E+02	.14790E+02	.14813E+02	.14821E+02			
1.95	.13858E+02	.14266E+02	.14515E+02	.14664E+02	.14750E+02	.14795E+02	.14815E+02				
2.00	.13866E+02	.14278E+02	.14527E+02	.14675E+02	.14757E+02						
2.05	.13875E+02	.14291E+02	.14540E+02								
2.10	.13886E+02	.14306E+02									

χ_{max}^3

TABLE XIX. THERMAL ROTON ENERGY GAP (K)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.85699E+01	.84330E+01	.82961E+01	.81592E+01	.80223E+01	.78854E+01	.77485E+01	.76115E+01	.74746E+01	.73377E+01	.72008E+01
.15	.85705E+01	.84336E+01	.82966E+01	.81596E+01	.80227E+01	.78857E+01	.77488E+01	.76118E+01	.74749E+01	.73379E+01	.72010E+01
.20	.85709E+01	.84339E+01	.82969E+01	.81599E+01	.80229E+01	.78859E+01	.77489E+01	.76118E+01	.74748E+01	.73378E+01	.72008E+01
.25	.85710E+01	.84340E+01	.82969E+01	.81598E+01	.80228E+01	.78857E+01	.77487E+01	.76116E+01	.74745E+01	.73375E+01	.72004E+01
.30	.85709E+01	.84338E+01	.82967E+01	.81596E+01	.80225E+01	.78854E+01	.77483E+01	.76111E+01	.74740E+01	.73369E+01	.71998E+01
.35	.85705E+01	.84334E+01	.82962E+01	.81591E+01	.80220E+01	.78848E+01	.77477E+01	.76105E+01	.74734E+01	.73362E+01	.71991E+01
.40	.85700E+01	.84328E+01	.82956E+01	.81584E+01	.80213E+01	.78841E+01	.77469E+01	.76097E+01	.74726E+01	.73354E+01	.71982E+01
.45	.85692E+01	.84320E+01	.82948E+01	.81576E+01	.80204E+01	.78833E+01	.77461E+01	.76089E+01	.74717E+01	.73345E+01	.71973E+01
.50	.85683E+01	.84311E+01	.82939E+01	.81567E+01	.80195E+01	.78823E+01	.77452E+01	.76080E+01	.74708E+01	.73336E+01	.71964E+01
.55	.85673E+01	.84301E+01	.82929E+01	.81557E+01	.80186E+01	.78814E+01	.77442E+01	.76070E+01	.74699E+01	.73327E+01	.71955E+01
.60	.85661E+01	.84290E+01	.82918E+01	.81547E+01	.80175E+01	.78804E+01	.77432E+01	.76061E+01	.74690E+01	.73319E+01	.71947E+01
.65	.85650E+01	.84278E+01	.82907E+01	.81536E+01	.80165E+01	.78794E+01	.77423E+01	.76051E+01	.74680E+01	.73309E+01	.71938E+01
.70	.85637E+01	.84266E+01	.82896E+01	.81525E+01	.80154E+01	.78783E+01	.77412E+01	.76041E+01	.74670E+01	.73300E+01	.71929E+01
.75	.85624E+01	.84254E+01	.82883E+01	.81512E+01	.80142E+01	.78771E+01	.77400E+01	.76030E+01	.74659E+01	.73288E+01	.71918E+01
.80	.85610E+01	.84240E+01	.82869E+01	.81498E+01	.80128E+01	.78757E+01	.77386E+01	.76016E+01	.74645E+01	.73274E+01	.71904E+01
.85	.85595E+01	.84224E+01	.82853E+01	.81482E+01	.80111E+01	.78740E+01	.77369E+01	.75997E+01	.74626E+01	.73255E+01	.71884E+01
.90	.85578E+01	.84206E+01	.82834E+01	.81461E+01	.80089E+01	.78717E+01	.77345E+01	.75973E+01	.74601E+01	.73229E+01	.71857E+01
.95	.85557E+01	.84183E+01	.82809E+01	.81435E+01	.80061E+01	.78687E+01	.77313E+01	.75940E+01	.74566E+01	.73192E+01	.71818E+01
1.00	.85531E+01	.84155E+01	.82778E+01	.81401E+01	.80024E+01	.78647E+01	.77271E+01	.75894E+01	.74517E+01	.73140E+01	.71763E+01
1.05	.85499E+01	.84118E+01	.82737E+01	.81356E+01	.79975E+01	.78594E+01	.77213E+01	.75832E+01	.74451E+01	.73070E+01	.71689E+01
1.10	.85458E+01	.84071E+01	.82684E+01	.81297E+01	.79910E+01	.78523E+01	.77136E+01	.75749E+01	.74362E+01	.72975E+01	.71588E+01

Δ_t/k

TABLE XIX. THERMAL ROTON ENERGY GAP (K) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.85458E+01	.84071E+01	.82684E+01	.81297E+01	.79910E+01	.78523E+01	.77136E+01	.75749E+01	.74362E+01	.72975E+01	.71588E+01
1.15	.85404E+01	.84009E+01	.82614E+01	.81219E+01	.79824E+01	.78429E+01	.77034E+01	.75639E+01	.74244E+01	.72849E+01	.71454E+01
1.20	.85335E+01	.83930E+01	.82524E+01	.81119E+01	.79713E+01	.78308E+01	.76902E+01	.75497E+01	.74091E+01	.72686E+01	.71280E+01
1.25	.85247E+01	.83828E+01	.82409E+01	.80990E+01	.79571E+01	.78152E+01	.76733E+01	.75314E+01	.73895E+01	.72476E+01	.71057E+01
1.30	.85135E+01	.83699E+01	.82263E+01	.80827E+01	.79391E+01	.77955E+01	.76519E+01	.75083E+01	.73647E+01	.72211E+01	.70775E+01
1.35	.84994E+01	.83537E+01	.82080E+01	.80623E+01	.79166E+01	.77709E+01	.76252E+01	.74795E+01	.73337E+01	.71880E+01	.70423E+01
1.40	.84818E+01	.83335E+01	.81852E+01	.80369E+01	.78886E+01	.77404E+01	.75921E+01	.74438E+01	.72955E+01	.71472E+01	.69989E+01
1.45	.84600E+01	.83086E+01	.81572E+01	.80058E+01	.78544E+01	.77030E+01	.75516E+01	.74001E+01	.72487E+01	.70973E+01	.69459E+01
1.50	.84333E+01	.82782E+01	.81230E+01	.79679E+01	.78127E+01	.76576E+01	.75025E+01	.73473E+01	.71922E+01	.70370E+01	.68819E+01
1.55	.84009E+01	.82413E+01	.80817E+01	.79222E+01	.77626E+01	.76030E+01	.74434E+01	.72839E+01	.71243E+01	.69647E+01	.68051E+01
1.60	.83618E+01	.81970E+01	.80322E+01	.78675E+01	.77027E+01	.75379E+01	.73731E+01	.72083E+01	.70435E+01	.68787E+01	.67139E+01
1.65	.83151E+01	.81442E+01	.79733E+01	.78025E+01	.76316E+01	.74607E+01	.72898E+01	.71190E+01	.69481E+01	.67772E+01	.66063E+01
1.70	.82596E+01	.80817E+01	.79037E+01	.77258E+01	.75479E+01	.73699E+01	.71920E+01	.70140E+01	.68361E+01	.66582E+01	.64802E+01
1.75	.81942E+01	.80081E+01	.78220E+01	.76360E+01	.74499E+01	.72638E+01	.70777E+01	.68916E+01	.67055E+01	.65194E+01	.63333E+01
1.80	.81176E+01	.79222E+01	.77267E+01	.75313E+01	.73359E+01	.71404E+01	.69450E+01	.67496E+01	.65541E+01	.63587E+01	.61633E+01
1.85	.80283E+01	.78222E+01	.76161E+01	.74100E+01	.72039E+01	.69978E+01	.67917E+01	.65857E+01	.63796E+01	.61735E+01	
1.90	.79249E+01	.77067E+01	.74885E+01	.72703E+01	.70521E+01	.68339E+01	.66157E+01	.63975E+01			
1.95	.78057E+01	.75738E+01	.73419E+01	.71100E+01	.68781E+01	.66452E+01	.64143E+01				
2.00	.76690E+01	.74217E+01	.71744E+01	.69271E+01	.66797E+01						
2.05	.75130E+01	.72483E+01	.69837E+01								
2.10	.73355E+01	.70515E+01									

Δ_t/k

TABLE XX. ROTON EFFECTIVE MASS (m_{He})

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.16010E+00	.15555E+00	.15160E+00	.14809E+00	.14490E+00	.14197E+00	.13926E+00	.13673E+00	.13435E+00	.13210E+00	.12997E+00
.15	.16011E+00	.15556E+00	.15161E+00	.14809E+00	.14491E+00	.14198E+00	.13927E+00	.13673E+00	.13435E+00	.13210E+00	.12997E+00
.20	.16012E+00	.15557E+00	.15162E+00	.14810E+00	.14491E+00	.14198E+00	.13927E+00	.13674E+00	.13435E+00	.13210E+00	.12997E+00
.25	.16012E+00	.15557E+00	.15162E+00	.14810E+00	.14491E+00	.14198E+00	.13927E+00	.13673E+00	.13435E+00	.13210E+00	.12996E+00
.30	.16012E+00	.15557E+00	.15162E+00	.14810E+00	.14490E+00	.14198E+00	.13926E+00	.13672E+00	.13434E+00	.13209E+00	.12995E+00
.35	.16011E+00	.15556E+00	.15161E+00	.14809E+00	.14490E+00	.14197E+00	.13925E+00	.13671E+00	.13433E+00	.13208E+00	.12994E+00
.40	.16010E+00	.15555E+00	.15160E+00	.14808E+00	.14489E+00	.14196E+00	.13924E+00	.13670E+00	.13432E+00	.13206E+00	.12992E+00
.45	.16009E+00	.15554E+00	.15159E+00	.14807E+00	.14487E+00	.14194E+00	.13923E+00	.13669E+00	.13430E+00	.13205E+00	.12991E+00
.50	.16007E+00	.15553E+00	.15157E+00	.14805E+00	.14486E+00	.14193E+00	.13921E+00	.13667E+00	.13429E+00	.13203E+00	.12989E+00
.55	.16006E+00	.15551E+00	.15156E+00	.14804E+00	.14484E+00	.14191E+00	.13920E+00	.13666E+00	.13427E+00	.13202E+00	.12988E+00
.60	.16004E+00	.15549E+00	.15154E+00	.14802E+00	.14483E+00	.14190E+00	.13918E+00	.13664E+00	.13425E+00	.13200E+00	.12986E+00
.65	.16002E+00	.15548E+00	.15152E+00	.14800E+00	.14481E+00	.14188E+00	.13916E+00	.13662E+00	.13424E+00	.13198E+00	.12984E+00
.70	.16000E+00	.15546E+00	.15150E+00	.14798E+00	.14479E+00	.14186E+00	.13914E+00	.13660E+00	.13421E+00	.13196E+00	.12981E+00
.75	.15997E+00	.15544E+00	.15148E+00	.14796E+00	.14477E+00	.14183E+00	.13911E+00	.13657E+00	.13418E+00	.13193E+00	.12978E+00
.80	.15995E+00	.15541E+00	.15145E+00	.14793E+00	.14474E+00	.14180E+00	.13908E+00	.13654E+00	.13415E+00	.13189E+00	.12974E+00
.85	.15993E+00	.15538E+00	.15143E+00	.14790E+00	.14470E+00	.14176E+00	.13904E+00	.13649E+00	.13410E+00	.13184E+00	.12969E+00
.90	.15990E+00	.15535E+00	.15139E+00	.14786E+00	.14465E+00	.14171E+00	.13898E+00	.13643E+00	.13403E+00	.13176E+00	.12961E+00
.95	.15986E+00	.15531E+00	.15134E+00	.14780E+00	.14459E+00	.14164E+00	.13890E+00	.13635E+00	.13394E+00	.13167E+00	.12951E+00
1.00	.15981E+00	.15525E+00	.15128E+00	.14773E+00	.14451E+00	.14155E+00	.13880E+00	.13623E+00	.13382E+00	.13153E+00	.12937E+00
1.05	.15975E+00	.15518E+00	.15119E+00	.14763E+00	.14440E+00	.14142E+00	.13866E+00	.13608E+00	.13366E+00	.13136E+00	.12918E+00
1.10	.15967E+00	.15509E+00	.15108E+00	.14750E+00	.14425E+00	.14126E+00	.13848E+00	.13589E+00	.13344E+00	.13113E+00	.12894E+00

TABLE XX. ROTON EFFECTIVE MASS (m_{He}) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.15967E+00	.15509E+00	.15108E+00	.14750E+00	.14425E+00	.14126E+00	.13848E+00	.13589E+00	.13344E+00	.13113E+00	.12894E+00
1.15	.15957E+00	.15497E+00	.15094E+00	.14734E+00	.14406E+00	.14105E+00	.13825E+00	.13564E+00	.13317E+00	.13084E+00	.12862E+00
1.20	.15944E+00	.15481E+00	.15075E+00	.14712E+00	.14382E+00	.14078E+00	.13796E+00	.13531E+00	.13282E+00	.13046E+00	.12822E+00
1.25	.15927E+00	.15460E+00	.15052E+00	.14685E+00	.14352E+00	.14044E+00	.13759E+00	.13491E+00	.13238E+00	.12999E+00	.12771E+00
1.30	.15905E+00	.15435E+00	.15022E+00	.14651E+00	.14313E+00	.14002E+00	.13712E+00	.13440E+00	.13183E+00	.12940E+00	.12708E+00
1.35	.15878E+00	.15402E+00	.14984E+00	.14608E+00	.14266E+00	.13949E+00	.13654E+00	.13377E+00	.13116E+00	.12868E+00	.12631E+00
1.40	.15844E+00	.15362E+00	.14938E+00	.14556E+00	.14207E+00	.13885E+00	.13584E+00	.13301E+00	.13034E+00	.12779E+00	.12537E+00
1.45	.15802E+00	.15313E+00	.14881E+00	.14492E+00	.14136E+00	.13806E+00	.13498E+00	.13209E+00	.12934E+00	.12673E+00	.12423E+00
1.50	.15750E+00	.15253E+00	.14813E+00	.14415E+00	.14050E+00	.13712E+00	.13396E+00	.13098E+00	.12815E+00	.12545E+00	.12287E+00
1.55	.15688E+00	.15180E+00	.14730E+00	.14322E+00	.13948E+00	.13600E+00	.13273E+00	.12966E+00	.12673E+00	.12394E+00	.12126E+00
1.60	.15612E+00	.15093E+00	.14631E+00	.14212E+00	.13826E+00	.13466E+00	.13129E+00	.12810E+00	.12506E+00	.12215E+00	.11936E+00
1.65	.15522E+00	.14990E+00	.14514E+00	.14081E+00	.13682E+00	.13309E+00	.12959E+00	.12626E+00	.12310E+00	.12006E+00	.11714E+00
1.70	.15415E+00	.14867E+00	.14376E+00	.13928E+00	.13513E+00	.13125E+00	.12760E+00	.12413E+00	.12081E+00	.11763E+00	.11456E+00
1.75	.15289E+00	.14724E+00	.14215E+00	.13749E+00	.13317E+00	.12912E+00	.12529E+00	.12165E+00	.11817E+00	.11482E+00	.11158E+00
1.80	.15142E+00	.14556E+00	.14027E+00	.13541E+00	.13089E+00	.12665E+00	.12263E+00	.11880E+00	.11512E+00	.11158E+00	.10815E+00
1.85	.14970E+00	.14361E+00	.13810E+00	.13301E+00	.12827E+00	.12381E+00	.11957E+00	.11553E+00	.11164E+00	.10788E+00	
1.90	.14771E+00	.14137E+00	.13560E+00	.13026E+00	.12527E+00	.12056E+00	.11608E+00	.11179E+00			
1.95	.14542E+00	.13880E+00	.13273E+00	.12711E+00	.12185E+00	.11686E+00	.11211E+00				
2.00	.14280E+00	.13585E+00	.12947E+00	.12353E+00	.11796E+00						
2.05	.13981E+00	.13250E+00	.12577E+00								
2.10	.13641E+00	.12871E+00									

TABLE XXI. MOMENTUM AT ROTON MINIMUM ($\mathring{A}^{-1}$)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
.10	.19129E+01	.19308E+01	.19462E+01	.19556E+01	.19716E+01	.19826E+01	.19926E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.15	.19129E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19826E+01	.19926E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.20	.19129E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19825E+01	.19926E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.25	.19129E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19825E+01	.19926E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.30	.19129E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.35	.19129E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.40	.19129E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.45	.19129E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.50	.19129E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.55	.19128E+01	.19308E+01	.19461E+01	.19556E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.60	.19128E+01	.19308E+01	.19461E+01	.19555E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.65	.19128E+01	.19308E+01	.19461E+01	.19555E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20261E+01
.70	.19128E+01	.19307E+01	.19461E+01	.19555E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20104E+01	.20185E+01	.20262E+01
.75	.19128E+01	.19307E+01	.19461E+01	.19555E+01	.19716E+01	.19825E+01	.19925E+01	.20018E+01	.20105E+01	.20186E+01	.20262E+01
.80	.19128E+01	.19307E+01	.19461E+01	.19555E+01	.19716E+01	.19825E+01	.19926E+01	.20019E+01	.20105E+01	.20186E+01	.20263E+01
.85	.19128E+01	.19307E+01	.19461E+01	.19556E+01	.19716E+01	.19826E+01	.19926E+01	.20019E+01	.20106E+01	.20187E+01	.20263E+01
.90	.19128E+01	.19307E+01	.19461E+01	.19556E+01	.19717E+01	.19826E+01	.19927E+01	.20020E+01	.20106E+01	.20188E+01	.20264E+01
.95	.19128E+01	.19307E+01	.19461E+01	.19556E+01	.19717E+01	.19827E+01	.19927E+01	.20021E+01	.20107E+01	.20189E+01	.20265E+01
1.00	.19129E+01	.19307E+01	.19461E+01	.19556E+01	.19716E+01	.19828E+01	.19928E+01	.20022E+01	.20109E+01	.20190E+01	.20267E+01
1.05	.19128E+01	.19307E+01	.19462E+01	.19557E+01	.19718E+01	.19829E+01	.19930E+01	.20023E+01	.20110E+01	.20192E+01	.20269E+01
1.10	.19128E+01	.19308E+01	.19462E+01	.19558E+01	.19719E+01	.19830E+01	.19931E+01	.20025E+01	.20112E+01	.20194E+01	.20271E+01

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TABLE XXI. MOMENTUM AT ROTON MINIMUM ($\AA^{-1}$) (continued)

Temp. (K)	Pressure (atm) 0.00	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00
1.10	.19128E+01	.19308E+01	.19462E+01	.19598E+01	.19719E+01	.19830E+01	.19931E+01	.20025E+01	.20112E+01	.20194E+01	.20271E+01
1.15	.19128E+01	.19308E+01	.19463E+01	.19599E+01	.19721E+01	.19831E+01	.19933E+01	.20027E+01	.20114E+01	.20196E+01	.20274E+01
1.20	.19128E+01	.19309E+01	.19464E+01	.19600E+01	.19722E+01	.19833E+01	.19935E+01	.20029E+01	.20117E+01	.20199E+01	.20277E+01
1.25	.19128E+01	.19309E+01	.19465E+01	.19601E+01	.19724E+01	.19835E+01	.19938E+01	.20032E+01	.20120E+01	.20203E+01	.20281E+01
1.30	.19123E+01	.19310E+01	.19466E+01	.19603E+01	.19726E+01	.19838E+01	.19941E+01	.20036E+01	.20124E+01	.20207E+01	.20285E+01
1.35	.19129E+01	.19311E+01	.19467E+01	.19605E+01	.19729E+01	.19841E+01	.19944E+01	.20040E+01	.20129E+01	.20212E+01	.20290E+01
1.40	.19129E+01	.19312E+01	.19469E+01	.19608E+01	.19732E+01	.19845E+01	.19949E+01	.20044E+01	.20134E+01	.20217E+01	.20296E+01
1.45	.19130E+01	.19313E+01	.19471E+01	.19611E+01	.19736E+01	.19849E+01	.19953E+01	.20050E+01	.20140E+01	.20224E+01	.20303E+01
1.50	.19130E+01	.19315E+01	.19474E+01	.19614E+01	.19740E+01	.19854E+01	.19959E+01	.20056E+01	.20145E+01	.20231E+01	.20311E+01
1.55	.19131E+01	.19317E+01	.19477E+01	.19618E+01	.19745E+01	.19860E+01	.19965E+01	.20063E+01	.20154E+01	.20240E+01	.20320E+01
1.60	.19132E+01	.19319E+01	.19480E+01	.19623E+01	.19750E+01	.19866E+01	.19973E+01	.20071E+01	.20163E+01	.20249E+01	.20330E+01
1.65	.19134E+01	.19322E+01	.19484E+01	.19628E+01	.19757E+01	.19874E+01	.19981E+01	.20081E+01	.20174E+01	.20260E+01	.20342E+01
1.70	.19135E+01	.19325E+01	.19489E+01	.19634E+01	.19764E+01	.19882E+01	.19991E+01	.20092E+01	.20186E+01	.20273E+01	.20356E+01
1.75	.19137E+01	.19328E+01	.19494E+01	.19641E+01	.19772E+01	.19892E+01	.20002E+01	.20104E+01	.20199E+01	.20288E+01	.20371E+01
1.80	.19139E+01	.19332E+01	.19500E+01	.19648E+01	.19782E+01	.19903E+01	.20015E+01	.20118E+01	.20214E+01	.20304E+01	.20389E+01
1.85	.19141E+01	.19337E+01	.19507E+01	.19658E+01	.19793E+01	.19916E+01	.20029E+01	.20134E+01	.20232E+01	.20323E+01	
1.90	.19143E+01	.19342E+01	.19515E+01	.19668E+01	.19806E+01	.19931E+01	.20046E+01	.20153E+01			
1.95	.19146E+01	.19348E+01	.19524E+01	.19680E+01	.19820E+01	.19948E+01	.20065E+01				
2.00	.19150E+01	.19355E+01	.19534E+01	.19693E+01	.19837E+01						
2.05	.19154E+01	.19363E+01	.19546E+01								
2.10	.19158E+01	.19372E+01									

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TABLE XXII. COEFFICIENTS u_1 AND a_n OF THE MDC SERIES ($K \cdot Å^n$)

T (K)	P (atm)	u_1	a_3	a_4	a_5	a_6	a_7	a_8
0.25	0.00	18.197294	40.392212	-148.399590	193.906639	-125.673828	40.273163	-5.051226
0.25	2.50	19.667132	25.002220	-108.048447	147.918552	-98.697950	32.267731	-4.097425
0.25	5.00	20.946748	14.545467	-83.450813	121.619660	-84.014912	27.993724	-3.590226
0.25	7.50	22.087739	6.666134	-66.839668	105.660024	-75.408146	25.551579	-3.301260
0.25	10.00	23.122439	0.238911	-54.540337	94.732841	-69.981030	24.063075	-3.125751
0.25	12.50	24.072573	-5.295059	-44.747124	86.783516	-66.325668	23.103241	-3.013189
0.25	15.00	24.953532	-10.261622	-36.419163	80.493637	-63.640234	22.431275	-2.935082
0.25	17.50	25.776669	-14.841613	-28.992477	75.163475	-61.499905	21.920452	-2.876501
0.25	20.00	26.550618	-19.148213	-22.120266	70.366096	-59.646589	21.493942	-2.828398
0.25	22.50	27.282121	-23.245555	-15.613583	65.872196	-57.942348	21.110641	-2.785905
0.25	25.00	27.976554	-27.177349	-9.348080	61.533890	-56.299343	20.744548	-2.745946
0.50	0.00	18.205668	40.256992	-148.063622	193.554619	-125.487410	40.223897	-5.046043
0.50	2.50	19.671720	24.919998	-107.848022	147.716293	-98.596712	32.242942	-4.095061
0.50	5.00	20.948719	14.481995	-83.285866	121.648155	-83.928465	27.972796	-3.588288
0.50	7.50	22.087786	6.624533	-66.725693	105.531162	-75.350203	25.538529	-3.300199
0.50	10.00	23.121006	0.219105	-54.481724	94.674644	-69.957117	24.059593	-3.125759
0.50	12.50	24.069950	-5.291285	-44.749111	86.790768	-66.337515	23.109499	-3.014248
0.50	15.00	24.949937	-10.245844	-36.438087	80.517403	-63.660755	22.439881	-2.936396
0.50	17.50	25.772259	-14.817477	-29.041698	75.219700	-61.538231	21.933947	-2.878347
0.50	20.00	26.545509	-19.106045	-22.220032	70.479752	-59.717305	21.516427	-2.831225
0.50	22.50	27.276416	-23.191919	-15.743347	66.019012	-58.031603	21.138271	-2.789294
0.50	25.00	27.970323	-27.111522	-9.512177	61.720217	-56.411120	20.778472	-2.750023

TABLE XXII. COEFFICIENTS u_1 AND a_n OF THE MDC SERIES ($K \cdot \mathring{A}^n$) (continued)

T (K)	P (atm)	u_1	a_3	a_4	a_5	a_6	a_7	a_8
0.75	0.00	18.213680	40.102982	-147.685852	193.173271	-125.297533	40.177937	-5.041745
0.75	2.50	15.669701	24.864193	-107.687485	147.548790	-98.517328	32.226620	-4.093978
0.75	5.00	20.939762	14.512241	-83.329277	121.691097	-83.961906	27.986838	-3.590499
0.75	7.50	22.073709	6.718538	-66.918991	105.727161	-75.464230	25.573969	-3.304679
0.75	10.00	23.102968	0.371523	-54.817944	95.019470	-70.149857	24.115802	-3.132410
0.75	12.50	24.048740	-5.099443	-45.178711	87.230797	-66.579744	23.178533	-3.022212
0.75	15.00	24.926125	-10.003167	-37.013260	81.117130	-63.990383	22.532522	-2.946870
0.75	17.50	25.746255	-14.538903	-29.695496	75.901089	-61.910618	22.037673	-2.889952
0.75	20.00	26.517637	-18.790549	-22.971039	71.267025	-60.146923	21.635337	-2.844407
0.75	22.50	27.246910	-22.842522	-16.584217	66.904034	-58.513844	21.271053	-2.803906
0.75	25.00	27.939354	-26.745650	-10.390423	62.641293	-56.910693	20.915286	-2.764991
1.00	0.00	18.203727	40.076466	-147.562019	193.031712	-125.235575	40.169908	-5.041892
1.00	2.50	15.639285	25.067619	-108.093834	147.946568	-98.742962	32.295641	-4.102588
1.00	5.00	20.895141	14.905870	-84.209160	122.586929	-84.455740	28.128692	-3.607073
1.00	7.50	22.018587	7.268766	-68.177322	107.024460	-76.175083	25.774459	-3.327536
1.00	10.00	23.039693	1.061666	-56.438969	96.712818	-71.078676	24.375303	-3.161680
1.00	12.50	23.978933	-4.288704	-47.117936	89.273804	-67.700961	23.490731	-3.057052
1.00	15.00	24.850915	-9.084592	-39.241199	83.430110	-65.288015	22.892635	-2.986913
1.00	17.50	25.666502	-13.918688	-32.200203	78.572727	-63.378693	22.443929	-2.934783
1.00	20.00	26.433977	-17.636769	-25.701046	74.188217	-61.751955	22.078427	-2.893111
1.00	22.50	27.159857	-21.658720	-19.532539	70.068275	-60.252512	21.750099	-2.856389
1.00	25.00	27.849335	-25.470152	-13.595284	66.094807	-58.809614	21.437674	-2.822051

a_n

TABLE XXII. COEFFICIENTS u_1 AND a_n OF THE MDC SERIES ($K \cdot Å^n$) (continued)

T (K)	P (atm)	u_1	a_3	a_4	a_5	a_6	a_7	a_8
1.25	0.00	18.146559	40.328751	-147.942833	193.357578	-125.441986	40.246759	-5.053594
1.25	2.50	19.543534	25.786789	-109.598709	149.455482	-99.594734	32.551552	-4.134131
1.25	5.00	20.775906	16.029335	-86.735031	125.209816	-85.926992	28.556725	-3.657469
1.25	7.50	21.880432	8.736088	-71.625771	110.675189	-78.224369	26.363497	-3.395612
1.25	10.00	22.886848	2.837589	-60.730911	101.328896	-73.669500	25.116021	-3.246333
1.25	12.50	23.814256	-2.222267	-52.223801	94.918093	-70.823446	24.379594	-3.157988
1.25	15.00	24.676472	-6.756527	-45.088840	89.877834	-68.897976	23.917485	-3.102588
1.25	17.50	25.483797	-10.931861	-38.793510	85.836807	-67.483625	23.606951	-3.065625
1.25	20.00	26.244180	-14.869450	-32.958069	82.322195	-66.295790	23.363600	-3.037219
1.25	22.50	26.963855	-18.609060	-27.463795	79.126517	-65.243584	23.159623	-3.013980
1.25	25.00	27.647846	-22.209774	-22.137211	76.122669	-64.204983	22.959472	-2.991793
1.50	0.00	17.999296	40.844276	-148.526169	193.774429	-125.771988	40.404515	-5.081080
1.50	2.50	19.337142	27.237755	-112.560776	152.481438	-101.392099	33.123016	-4.207763
1.50	5.00	20.524706	18.301868	-91.901314	130.723630	-89.147612	29.531414	-3.776143
1.50	7.50	21.597368	11.792301	-78.991959	118.742641	-82.915525	27.756262	-3.560945
1.50	10.00	22.579005	6.611614	-70.161400	111.805122	-79.702199	26.907317	-3.456040
1.50	12.50	23.486487	2.232557	-63.645805	107.649337	-78.280167	26.558233	-3.410676
1.50	15.00	24.332231	-1.662029	-58.403046	104.950353	-77.657764	26.465726	-3.396199
1.50	17.50	25.125643	-5.219641	-53.949429	103.190418	-77.516094	26.516846	-3.399087
1.50	20.00	25.874054	-8.538502	-49.967907	101.698865	-77.509482	26.634929	-3.410637
1.50	22.50	26.583274	-11.680868	-46.265827	100.455523	-77.794540	26.730423	-3.425645
1.50	25.00	27.253017	-14.662611	-42.800861	99.436915	-78.040472	26.942722	-3.448468

TABLE XXII. COEFFICIENTS u_1 AND a_n OF THE MDC SERIES ($K \cdot \mathring{A}^n$) (continued)

T (K)	P (atm)	u_1	a_3	a_4	a_5	a_6	a_7	a_8
1.75	0.00	17.699843	41.561306	-148.855461	193.865280	-126.194578	40.715668	-5.142722
1.75	2.50	18.937649	29.935719	-118.221489	158.638405	-105.307907	34.434075	-4.382418
1.75	5.00	20.054539	22.883030	-102.896492	143.117897	-96.695282	31.885620	-4.068469
1.75	7.50	21.074567	18.135865	-95.129250	137.223591	-94.031616	31.135631	-3.968601
1.75	10.00	22.015341	14.663788	-91.388550	136.264716	-94.445784	31.310048	-3.978427
1.75	12.50	22.890059	11.913940	-89.783928	138.101063	-96.424545	31.952319	-4.043904
1.75	15.00	23.708824	9.643444	-89.476418	141.339806	-99.287098	32.856399	-4.140561
1.75	17.50	24.479534	7.710716	-89.980789	145.452011	-102.642996	33.904351	-4.254394
1.75	20.00	25.208487	6.042431	-91.049698	150.121727	-106.299643	35.039082	-4.378736
1.75	22.50	25.900773	4.612823	-92.591904	155.223816	-110.175005	36.234326	-4.510264
1.75	25.00	26.560571	3.406898	-94.562317	160.702782	-114.235817	37.480163	-4.647790
2.00	0.00	17.152158	43.752022	-152.695351	198.702652	-130.235052	42.386198	-5.398743
2.00	2.50	18.221287	36.750774	-135.153824	178.807240	-118.324904	38.699657	-4.933464
2.00	5.00	19.217662	34.291206	-133.338120	179.382458	-119.194513	38.892541	-4.930122
2.00	7.50	20.147925	34.090286	-139.250092	189.935230	-126.241625	40.945777	-5.146739
2.00	10.00	21.019468	35.147121	-149.320854	205.760910	-136.509981	43.958963	-5.475962

Part II

Formulae and Discussion

1. Equation of State for Helium II

The only equation of state for helium II in the literature is that of Keesom (1942) based on the data of Keesom and Miss Keesom. It is reproduced in Table A2 of Wilks (1967).

Our empirical equation of state was developed from multiple regression analysis of the combined PVT data of Abraham et al. (1970), Boghosian & Meyer (1966, 1967), Elwell & Meyer (1967) and Kerr and Taylor (1964). The form was prompted by the success of the low temperature (T-independent) equation of state of Abraham et al. (1970). The resulting expression, which has temperature dependent coefficients, is

$$P(\rho, T) = A(T) + B(T)\rho + C(T)\rho^2 + D(T)\rho^3, \qquad (1)$$

where

$$A(T) = A_o + A_1T^2 + A_2T^3 + A_3T^4,$$

$$B(T) = B_o,$$

$$C(T) = C_o + C_1T^2 + C_2T^4,$$

$$D(T) = D_o + D_1T^2 + D_2T^3 + D_3T^4;$$

and

$$A_o = -74.28059,\ A_1 = -.23016,\ A_2 = -.41029,\ A_3 = -1.38002,$$

$$B_o = 2007.539,$$

$$C_o = -20944.09,\ C_1 = 28.05456\ \ C_2 = 254.3206,$$

$$D_o = 73300.0,\ D_1 = -124.4081,\ D_2 = 162.6083,\ D_3 = -1318.33.$$

Here P is in atmospheres, T is in degrees Kelvin, ρ is in grams per cubic centimeter. The constants are in the appropriate units of atm $gm^{-n} cm^{3n} K^{-m}$, where n is the power of ρ^n, and m is the power of T^m. Any variable P, ρ or T may be solved in terms of the other two by simple root searching methods. The standard error in pressure is $\pm$ $0.1969T^2$ atm K^{-2}.

Eq. (1) is shown in Fig. 1, plotted in the form V(P, T) - V(P, 0) [δ (Molar Volume)] vs. T for one atmosphere increments in P. To the left of the dotted lines, the thermal expansion is positive, to the right, it is negative. Beyond T = 1.5 K the change in molar volume becomes large and negative, and has not been drawn.

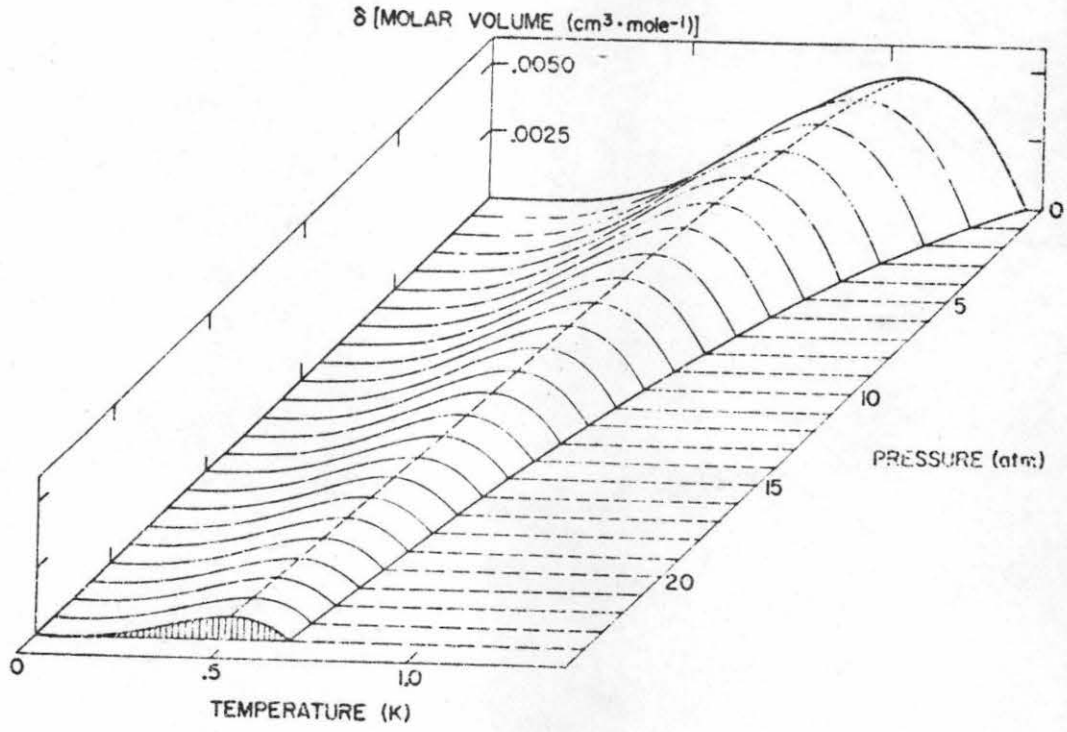

Figure 1.

The relative change in molar volume as calculated from the empirical PVT relation. The dotted line represents the locus of zero thermal expansion. (Note that the pressure increases toward the viewer.)

In order to complete the analysis successfully, the data of Boghosian & Meyer had to be slightly modified to match the T = 0 values of Abraham et al. There still remained, however, certain difficulties in matching different sets of PVT data (Boghosian & Meyer, Elwell & Meyer) at about 1.25 K for pressures greater than 10 atm. This mismatch (discussed in detail by Brooks, 1973) made it difficult to obtain a good fit in the region where the expansion coefficient changes sign, and α_p, which is defined by

$$\alpha_p = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_p , \tag{2}$$

is in only qualitative agreement with thermal expansion data. The tabulated values of α_p in Table V are <u>not</u> calculated from the equation of state, but from the Landau theory.

We show in Fig. 2 the general agreement of our equation of state with the experimental data of Boghosian & Meyer and Elwell & Meyer. The agreement of (1) in terms of $\rho(P,T)$ (Table I) or $V(P,T)$ (Table II) with the experimental data used in the analysis is in all cases better than $\pm$ .5%.

There are several other quantities which may be calculated from (1), such as the isothermal velocity of sound

$$u_1^2 = \left(\frac{\partial P}{\partial \rho}\right)_T . \tag{3}$$

Results calculated from (1) and (3) are shown in Fig. 3 with the data of Atkins & Stasior (1953) and Vignos & Fairbank (1966). Also shown is the velocity of sound corrected for thermal expansion using calculated values of C_p/C_v to be discussed below. The corrected velocity of sound (Table III)

is in ± 0.5% agreement with the experimental data below 1.5 K, and deviates no more than ± 4% between 1.5 K and 2.0 K.

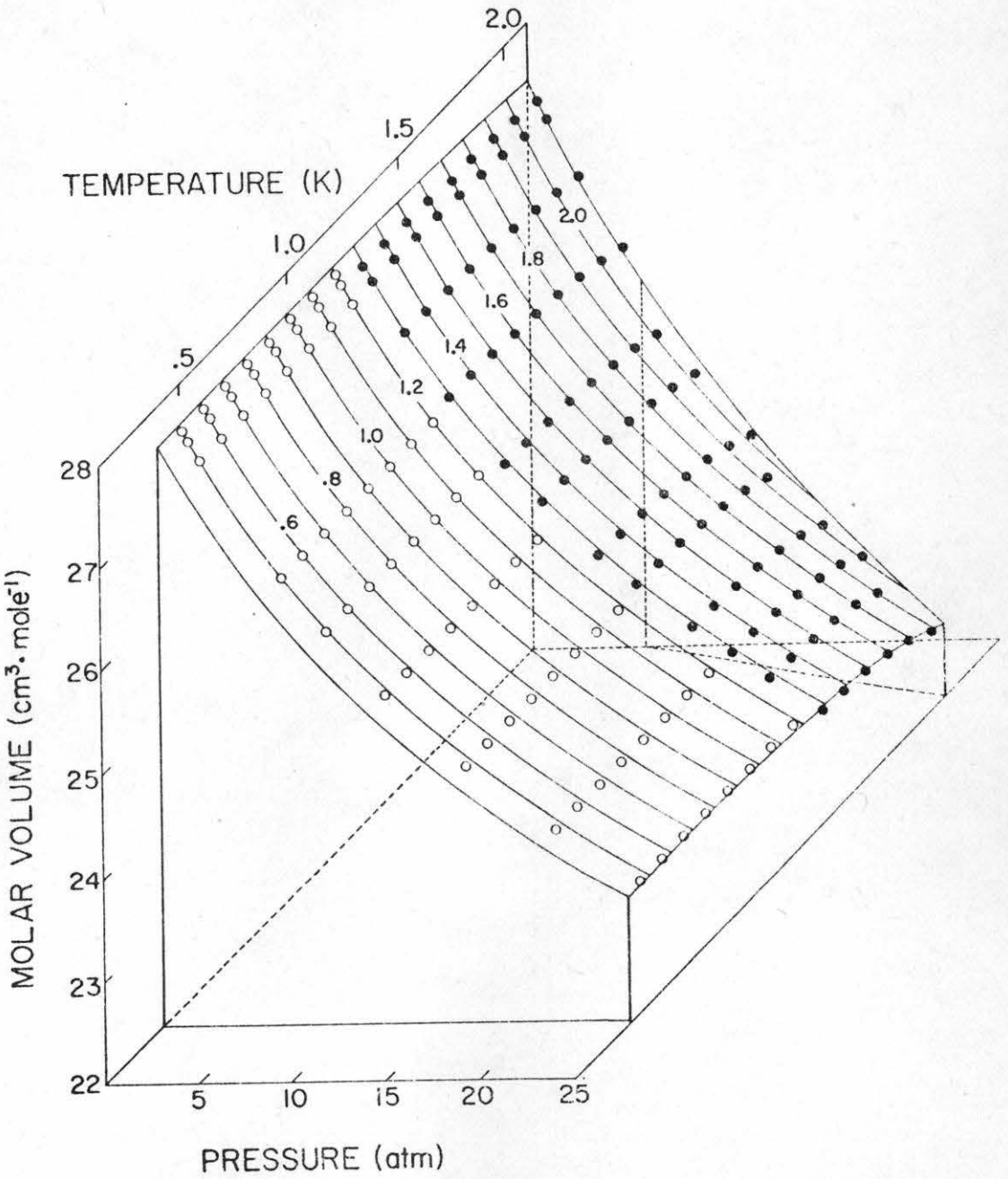

Figure 2.

The PVT surface of helium II. The solid lines are from (1); the solid circles are the data of Elwell & Meyer; the open circles are from Boghosian & Meyer, and represent the data as determined from their errata note. Deviations of the data from the lines are interpreted as vertical departures normal to the P-T plane.

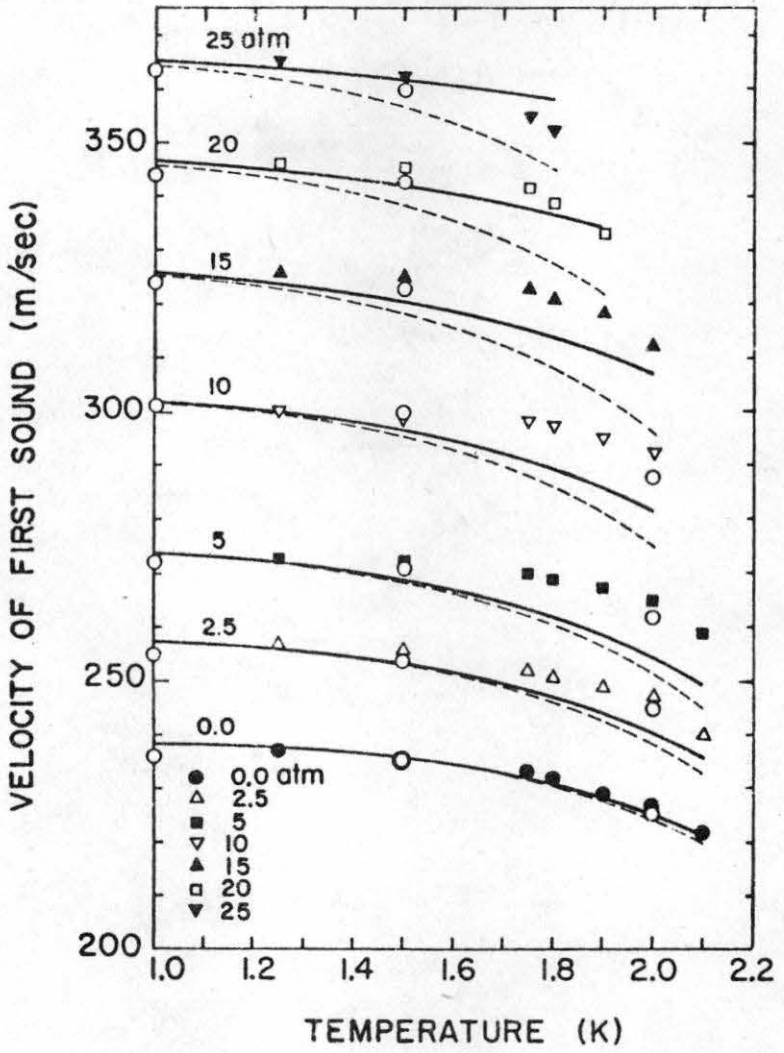

Figure 3.

The velocity of first sound u_1 vs. temperature for different pressures. The solid lines are for u_1, corrected for $C_p/C_v \neq 1$; the dotted lines are u_1 uncorrected. The open circles are the data of Vignos & Fairbank (1966). The rest of the data are from Atkins & Stasior (1953).

The isothermal compressibility

$$K_T = -\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_T , \tag{4}$$

has been calculated from Eq. (1) and is tabluated in Table IV. The deviation from the data of Boghosian & Meyer is at worst 8% low for $T \leq 1.2$ K. For $T \leq 1.8$ K and $P \leq 20$ atm the deviation from Elwell & Meyer is less than $\pm 3\%$.

The Gruneisen constant

$$u_G = \frac{\rho}{u_1}\left(\frac{\partial u_1}{\partial \rho}\right)_T , \tag{5}$$

and the second order derivative

$$w = \frac{\rho^2}{u_1}\left(\frac{\partial^2 u_1}{\partial \rho^2}\right)_T , \tag{6}$$

are listed in the short tables below. They are in agreement with the values of Abraham et al. at T = 0.1 K to within $\pm$ .25% for u_G and $\pm$ 1.5% for w.

TABLE 1. GRÜNEISEN CONSTANT u_G

Temp. (K)	Pressure (atm)					
	0	5	10	15	20	25
0.0	8.083	6.803	6.054	5.549	5.179	4.893
0.5	8.035	6.774	6.034	5.533	5.166	4.881
1.0	7.657	6.540	5.865	5.401	5.057	4.788

TABLE 2. SECOND ORDER DERIVATIVE (-) w

Temp. (K)	Pressure (atm)					
	0	5	10	15	20	25
0.0	2.843	2.608	2.461	2.356	2.276	2.212
0.5	2.835	2.603	2.456	2.352	2.273	2.209
1.0	2.767	2.557	2.421	2.324	2.249	2.188

2. The Excitation Spectrum

(a) Parametrization of neutron data

Until about one year ago the best available representation of the excitation spectrum, especially under pressure, was the Landau approximation:

$$\epsilon = u_1 p, \qquad (p \to 0) \tag{7}$$

$$\epsilon = \Delta + (p - p_0)^2 / 2\mu. \qquad (p \to p_0) \tag{8}$$

In (7) and (8), p_o and μ were considered functions of pressure, and Δ a function of pressure and temperature (see, for example, Donnelly, 1967, p. 213).

This situation was dramatically changed by the systematic studies of Dietrich, Huang, Graf & Passell (1972) at Brookhaven and Cowley & Woods (1971) at Chalk River. Donnelly (1972) and Brooks (1973) have found simple parametrizations of this data by considering Δ and μ to be functions of ρ only at T = 0:

$$\Delta(\rho,0)/k = (16.99 - 57.31\rho) \quad K \tag{9}$$

and

$$\mu(\rho,0) = (0.32 - 1.103\rho)\ m_4. \tag{10}$$

They have attempted a representation at finite temperatures by additional terms:

$$\Delta(\rho,T)/k = \Delta(\rho,0)/k - \frac{\rho_m}{\rho} T \left(1 - \frac{a N_r}{T}\right), \tag{11}$$

$$(a = 8.75 \times 10^{-23}\ cm^3 \cdot K)$$

and

$$\mu(\rho,T) = \mu(\rho,0)\ \Delta(\rho,T)/\Delta(\rho,0). \tag{12}$$

Finally we have the relation of Dietrich et al. for $p_o/\hbar$:

$$p_o/\hbar = 3.64\, \rho^{1/3}\ \text{Å}^{-1}. \tag{13}$$

If we wish to improve on the Landau approximation we need more experimental information. The maximum energy, ε_{max}, of single particle excitations near $Q = p/\hbar = 1.1\ \text{Å}^{-1}$ has recently been observed as a function of pressure by Passell et al. (1973). The position of ε_{max} in momentum space does not change noticably with pressure. The energy may be parametrized as

$$\epsilon_{max}/k = E_o + E_1\rho + E_2\rho^2 + E_3\rho^3, \tag{14}$$

where

$E_o = -216.5672$ K,

$E_1 = 3998.6005$ K gm^{-1} cm^3,

$E_2 = -23028.6027$ K gm^{-2} cm^6,

$E_3 = 44199.7232$ K gm^{-3} cm^9.

It is tabulated in Table XVIII.

For momenta larger than p_o, the slope of the spectrum approaches the velocity of sound, then bends over and goes to 2Δ for increasing momentum, finally terminating at p'. This behavior has been theoretically predicted by Pitaevskiĭ (1959) to be

$$\epsilon(p) = 2\Delta - \alpha \exp\left[-a/(p'-p)\right] \tag{15}$$

where α and a are constants. Neutron measurements have not yet been made over the (P,T) plane which would allow extraction of α and a as a function of temperature and pressure. Fortunately, this region of phase space has little thermodynamic content, and it is sufficient for many purposes to locate the momentum p_c to the right of p_o at which $d\varepsilon/dp$ from (8) reaches the velocity of sound, u_1, and continue the dispersion curve as a straight line of slope u_1:

$$\varepsilon(p) = u_1(p-p_c) + \varepsilon(p_c), \tag{16}$$

where

$$p_c = \mu u_1 + p_o. \tag{17}$$

(b) A series representation of the excitation spectrum

We have found that the series ($p \leq p_c$)

$$\varepsilon(p) = u_1 p + a_3 p^3 + a_4 p^4 + a_5 p^5 + a_6 p^6 + a_7 p^7 + a_8 p^8, \tag{18}$$

can be used to represent the neutron data up to $p = p_c$. We show in Fig. 4 the fit to the neutron data with equations (16)-(18).

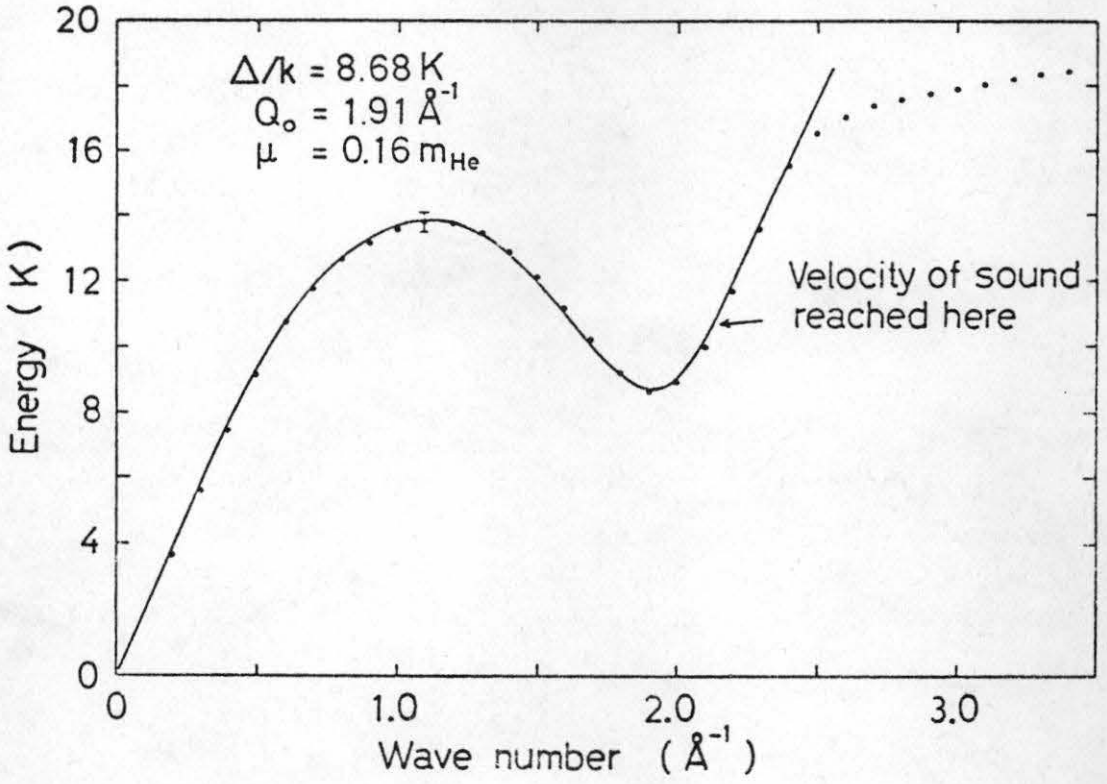

Figure 4

Energy vs. wave number at T = 1.1 K, P = 0 atm given by (18). The dispersion curve is continued as a straight line after the roton group velocity reaches u_1. The points are from Cowley & Woods (1971); the error bar represents the minimum quoted error ($\pm$ .2 K), and is not associated with any particular data point.

The coefficients a_3-a_8 are obtained by requiring that the curve meet the constraints discussed in section (a) above:

$$\epsilon(0) = 0\,; \quad \epsilon'(0) = u_1\,; \quad \epsilon(1.1) = \epsilon_{max}\,; \quad \epsilon'(1.1) = 0\,;$$

$$\epsilon(p_0) = \Delta\,; \quad \epsilon'(p_0) = 0\,; \quad \epsilon''(p_0) = \mu^{-1}. \tag{19}$$

3. Thermodynamic Calculations from Model Dispersion Curves

(a) Thermodynamic quantities

Thermodynamic quantities have been obtained by numerical integration over the curve determined by (18) and (16) which together we refer to as the "Model Dispersion Curve" or MDC. All quantities, of course, make use of the equation of state. Integrations in Q-space are in increments of 0.003 $\mathring{A}^{-1}$, and are performed by the simple Riemann sum method, which is sufficiently accurate compared with other methods, such as Simpson's rule in this problem. The range of integration is 0 to 3.0 $\mathring{A}^{-1}$.

The Helmholtz free energy of the excitation gas is

$$F = -\frac{kT}{2\pi^2\rho}\int_0^\infty \ln\left(1+n(Q)\right)Q^2\,dQ, \tag{20}$$

where

$$n(Q) = \left[e^{\epsilon(Q)/kT}-1\right]^{-1} \tag{21}$$

The total Helmholtz free energy of the liquid must include the sum of (20) and the ground state contribution $F_G(P,0)$ at T = 0. This can be determined easily from Eq. (1) by integrating the expression $dF_G = -PdV$; a similar integration will provide the ground state Gibbs free energy $d\Phi = VdP$. The results provide F_G and Φ_G at T = 0 to within an additive constant, L ($L = F_G(0,0) = \Phi_G(0,0)$, where L is the latent heat of vaporization extrapolated to zero temperature, and is approximately 14 cal/mole (from Keesom, 1942). The two ground state free energies are given as a function of pressure in Tables 3 and 4.

TABLE 3. Ground State Helmholtz Free Energy $\Delta F_G \equiv F_G(P,0) - F_G(0,0)$ $(ergs \cdot gm^{-1}) \times 10^{-6}$

	Pressure (atm)									
	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
ΔF_G	0	0.9297	3.3006	6.6760	10.8000	15.4987	20.6656	26.2145	32.0703	38.1851	47.5416

TABLE 4. Ground State Gibbs Free Energy $\Delta \Phi_G \equiv \Phi_G(P,0) - \Phi_G(0,0)$ $(ergs \cdot gm^{-1}) \times 10^{-6}$

	Pressure (atm)									
	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25
$\Delta \Phi_G$	0	68.823	136.064	201.680	266.018	329.191	391.477	452.937	513.532	573.393	632.2

The entropy is calculated from

$$S = \frac{k}{2\pi^2 \rho} \int_0^\infty \left\{ \frac{\epsilon(Q)/kT}{e^{\epsilon(Q)/kT} - 1} - \ln\left(1 - e^{-\epsilon(Q)/kT}\right) \right\} Q^2 dQ, \quad (22)$$

and the specific heat at constant pressure C_p is obtained from (22) by five point numerical differentiation with respect to temperature (cf. Bendt, Cowan & Yarnell, 1959).

The calculated entropy (Table VII) is in agreement with the data of Wiebes (1969) and Van den Meijdenberg et al. (1961) to within $\pm$ 6% over the entire range of values calculated. The specific heat C_p (Table VIII) deviates from Wiebes's data at worst $\pm$ 4% below 1.6 K, and a maximum of $\pm$ 20% with the data of Lounasmaa & Kojo (1959) in the range $1.5 \leq T < 2K$.

The specific heat at constant volume (Table IX) is obtained by calculating C_p/C_v from

$$\frac{C_p}{C_v} = \left[1 - \alpha_p^2 T / (4.0026\, C_p (\partial \rho / \partial P)_T) \right]^{-1}, \quad (23)$$

where α_p is calculated as discussed below, and $(\partial\rho/\partial P)_T$ comes from the equation of state. The term in α_p^2 is subject to an accumulation of errors and may be as much as 50% in error for T> 1.6 K.

The corrected velocity of sound (Table XI) is computed from

$$u_1 = \left[(C_P/C_V)(\partial P/\partial \rho)_T\right]^{\frac{1}{2}}. \qquad (24)$$

The thermal expansion coefficient has proved to be one of the most difficult quantities to obtain. As we have mentioned, the equation of state is not accurate enough for direct use of (2). Therefore we have used the Maxwell relation $(\partial V/\partial T)_P = -(\partial S/\partial P)_T$, and computed α_p (Table V) from the entropy by five point differentiation. Experimental values of α_p differ from author to author, and estimation of the error α_p is difficult. Hence, perhaps the most informative statement that can be made concerning the accuracy of the calculated α_p is that the average absolute deviation from the data of Elwell & Meyer, Boghosian & Meyer, and Mills & Sydoriak is 18%.

(b) The thermal roton gap

If the procedures of the previous three sections are followed, the thermodynamic results do not agree with experiment at any temperatures above 1 K (cf. Dietrich et al., 1972, Fig. 17). The disagreement arises whenever the neutron linewidth becomes significant, and attempts by Dietrich to include corrections for linewidth were unsuccessful. Since there is no theory at present which resolves this difficulty and since there is an urgent need to use dispersion curves above 1 K, we have adjusted the roton

energy gap so that the calculated entropy agrees with the experimental entropy. This new parameter is called the "thermal roton gap" Δ_t, and its usefulness can be judged by the fact that it allows us to estimate many quantities with reasonable accuracy and consistency. Quite clearly it should be an important goal in statistical mechanics to discover how to go from the neutron data to thermodynamics in the presence of broadened and temperature dependent energy levels.

The entropy used for the determination of Δ_t was that of Wiebes (1969) and Van den Meijdenberg et al. (1961). The latter data had to be adjusted slightly to agree with the former at T = 1.6 K; the manner of doing so is discussed by Brooks (1973).

We find that in general Δ_t lies above Δ as determined from neutron scattering, and that Δ_t approaches Δ increasingly closely below 1.3 K, except at the vapor pressure. There we find Δ_t/k = 8.57 K in contrast to neutron determinations of 8.65 - 8.68 K. The values of Δ_t obtained by computer search, parametrization and calculation are given in Table XIX. These values replace the neutron values of Eq. (11) and allow determination of the coefficients of the model dispersion curve at all temperatures and pressures. The results are tabulated in Table XXII, and yield $\varepsilon(Q)$ in degrees Kelvin for a_n in $K \cdot \mathring{A}^n$. These dispersion curves were used to calculate all tabulated properties related to the excitation spectrum. The dispersion curves automatically contain phonon dispersion, and are excellent fits to experimental thermodynamic and neutron data at low temperatures (Brooks, 1973, Brooks & Donnelly, 1973).

(c) The excitation number densities, and the normal and superfluid densities

The excitation density, which may be calculated by numerical integration, has been divided into a roton part N_r and a phonon part N_p by a perhaps arbitrary method, namely calling excitations with $Q<1.1$ $\mathring{A}^{-1}$ phonons, and $Q>1.1$ $\mathring{A}^{-1}$ rotons. The advantage is that this momentum division is pressure independent. Hence

$$N_p = \int_0^{1.1\mathring{A}^{-1}} \mathcal{N}(Q)\, d\tau, \tag{25}$$

and

$$N_r = \int_{1.1\mathring{A}^{-1}}^{3\mathring{A}^{-1}} \mathcal{N}(Q)\, d\tau. \tag{26}$$

Tabulations of (25) and (26) appear in Tables XII and XIII.

The normal fluid density is computed from

$$\rho_n = \frac{\hbar^2}{6\pi^2 kT} \int_0^\infty \frac{e^{\epsilon(Q)/kT}}{\left(e^{\epsilon(Q)/kT} - 1\right)^2} Q^4\, dQ, \tag{27}$$

and appears in Table XIV. From the equation of state one obtains $\rho_s = \rho - \rho_n$ and the ratios ρ_n/ρ and ρ_s/ρ, which appear in Tables XV, XIV, and XVII.

The values of ρ_n may be compared with torsional pendulum data of Romer & Duffy (1969) as shown in Fig. 5. The agreement is obviously not very good, though the general pressure and temperature dependence is satisfactory. Below 1.7 K, the calculated values of ρ_n agree with experimental

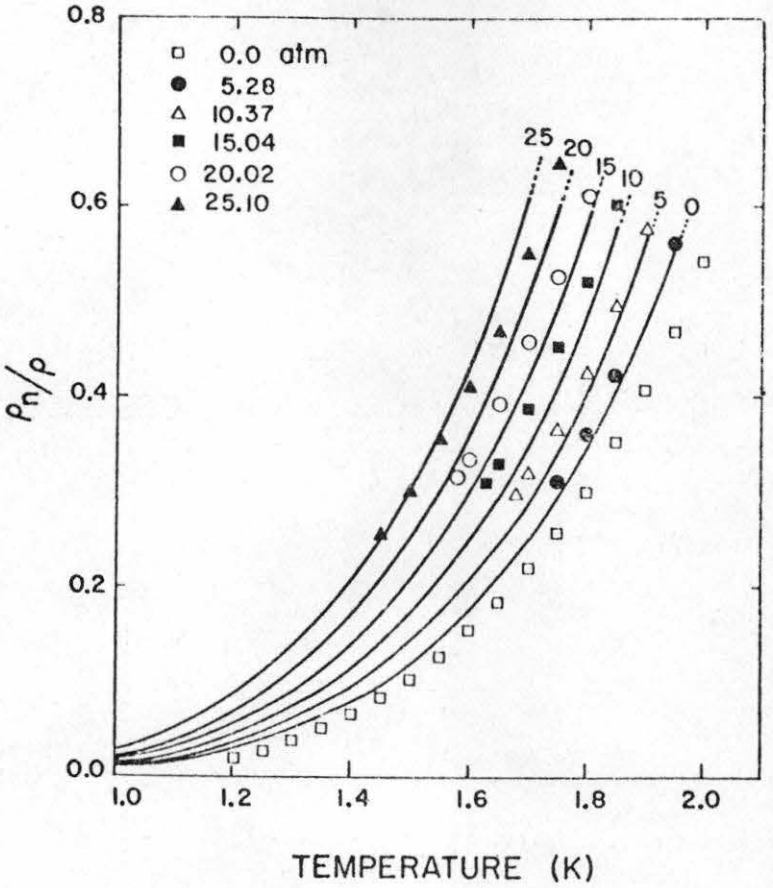

Figure 5.

The normal fluid fraction as a function of temperature for different pressures. The data are from Romer & Duffy (1969).

data (Romer & Duffy, 1969; Tough, McCormick & Dash, 1963) to within 10%. Cohen (1960) has indicated that there is no simple way to relate the normal fluid density and the neutron data, and that (27) may be incorrect. One should note parenthetically that calculating ρ_n/ρ from the Landau theory at the vapor pressure gives apparently better agreement with experiment. There is no reason to believe that this procedure is more reliable than the present one.

(d) The velocity of second sound

In the limit $C_p/C_v \to 1$

$$u_2^2 = (\rho_s/\rho_n)\ (TS^2/C_v).$$

It has recently been pointed out by Romer & Duffy (1969) that by replacing C_v by C_p, various errors due to thermal expansion cancel, and one obtains

$$u_2^2 = (\rho_s/\rho_n)(TS^2/C_p) \qquad (28)$$

We have used (28) to compute u_2 in Table XVII. Comparison above 0.8 K with experiment is shown in Fig. 6. Below 1.7 K, the calculated u_2 is lower than the data of Maurer & Herlin by no more than 10%. Below 0.8 K the calculated velocity shows marked effects of phonon dispersion which have yet to be observed (Brooks, 1973).

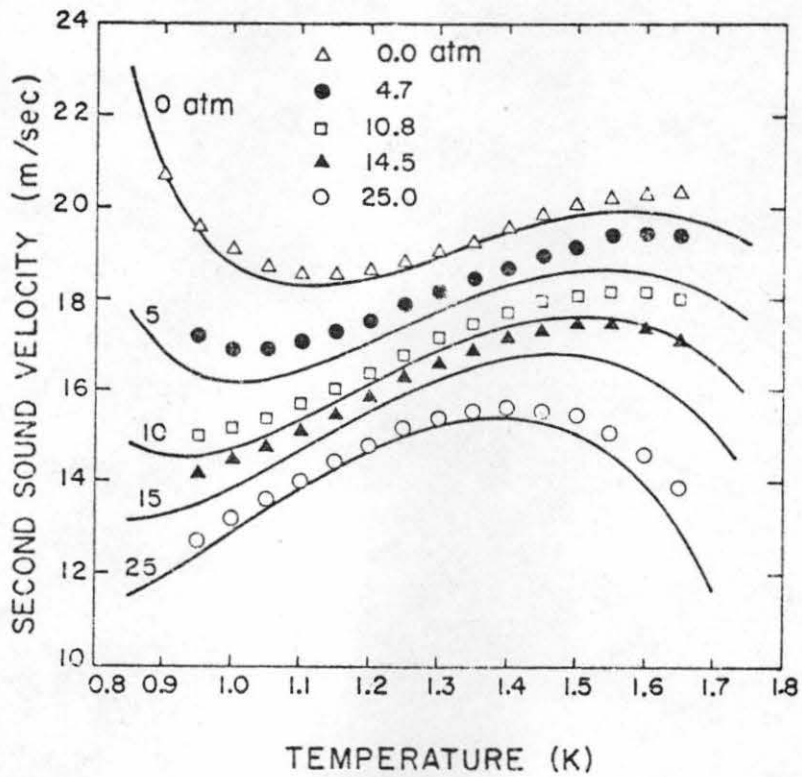

Figure 6.

The second sound velocity. Solid curves calculated from (28); data points, Maurer & Herlin (1951).

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