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Thermophysical properties of fluids. I. Argon, ethylene, parahydrogen, nitrogen, nitrogen trifluoride, and oxygen

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The thermophysical properties of argon, ethylene, parahydrogen, nitrogen, nitrogen trifluoride and oxygen are presented. Properties are given in tables and a standard set of equations is described. The tables list pressure, density, temperature, internal energy, enthalpy, entropy, heat capacity at constant volume, heat capacity at constant pressure, and sound velocity. Also included are viscosity, thermal conductivity, and dielectric constant, for some of the fluids. The equation and related properties of this report represent a compilation from the cooperative efforts of two research groups: the NBS Thermophysical Properties Division and the Center for Applied Thermodynamics Studies of the University of Idaho.

Key words: argon; critically evaluated data; density; ethylene; heat capacity; parahydrogen; nitrogen; nitrogen trifluoride; oxygen; thermodynamic properties; thermophysical properties.

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THERMOPHYSICAL PROPERTIES OF FLUIDS

1. Introduction

This work presents the thermophysical properties of several fluids in a useful and convenient form. The properties are presented in tabular form and can be computed by a standard set of equations, which is also provided. Special care was given in providing all of the property tables and equations in a uniform manner, so that one who is familiar with the form for one of the fluids can readily use the tables and equations for any fluid.

The equation used in the single-phase region is a 32-term modified Benedict-Webb-Rubin (MBWR) equation of state from a published source [5-10]¹. The MBWR, which has the advantages of high computational speed and accuracy, is widely used for the correlation of thermodynamic property data and has efficient computer programs for the calculation of thermophysical properties. This relation computes pressure from density and temperature and is also used with appropriate ancillary equations for the calculation of derived properties internal energy, enthalpy, entropy, heat capacity, and sound velocity as shown below. Other relations used include the equations for vapor pressure, saturated liquid and saturated vapor densities, and melting pressure. In addition, viscosity and thermal conductivity are computed for argon, nitrogen, and oxygen. Dielectric constant was calculated for the latter fluids and for hydrogen. Computation of the thermophysical properties of these fluids can be accomplished using a computer program which is an interactive system with prompting to aid in its use, described in a companion publication [1]. This program is a modification of program "Fluids Pack" by R. D. McCarty [2]. An early version of a program to represent thermophysical properties of several fluids is program "GASP" (gas properties) by R. C. Hendricks et al. [3]. The considerable improvements in the properties data that have occurred since that time are reflected in this report. Also, by retaining the parametric form of the equations for all fluids, the computer programming is much simplified. Only the numerical constants are changed from one fluid to the next.

This work includes three sets of tables; the properties for the liquid-vapor boundary, the properties of the liquid on the melting line, and properties for isobars on the pressure-density-temperature surface. The isobar tables comprise the largest portion of the tables. The temperature intervals on each isobar were selected by computer calculation of statistical significance to allow accurate linear interpolation of the properties. The temperature intervals were selected on the basis of relative rates of change and basic accuracies of density and heat capacity.

The MBWR equations and related properties found in this work originate from the cooperative efforts of two research groups: the NBS Thermophysical

Properties Division and the Center for Applied Thermodynamics Studies of the University of Idaho. The group from this laboratory includes R. D. McCarty, L. A. Weber, H. M. Roder, and R. D. Goodwin, and the University of Idaho group includes R. B. Stewart and R. T. Jacobsen.

The authors and their work are summarized as follows:

Fluid	A	C ₂ H ₄	H ₂	N ₂	NF ₃	O ₂
R. D. Goodwin					X	
R. T. Jacobsen	X	X			X	
R. D. McCarty		X	X		X	
H. M. Roder				X	X	
R. B. Stewart	X				X	
L. A. Weber						X X
Reference	[10]	[5]	[6]	[7]	[9]	[8]

2. Thermodynamic and Related Properties

2.1. The Equation of State

The relation for computing pressure as a function of temperature and density is a 32-term modified Benedict-Webb-Rubin (MBWR) equation of state. Its versatility and adaptability to efficient computer technique make it appropriate for use with multiproperty fitting techniques, where deviations from the *PVT* surface and heat capacity or sound velocity data are minimized simultaneously, resulting in a more accurate model than would be the case if the *PVT* data alone were used. This technique has been described by R. D. McCarty [2,4]. Other advantages of the MBWR are: (1) accurate representation of the thermodynamic surface over wide ranges of temperature and pressure, (2) adaptability to least squares fitting methods using many different kinds of experimental data, and (3) convenience in correlating data from different sources. An analytic function cannot present the proper behavior near the critical point, so that the MBWR is not valid in the critical region (see sec. 5).

The mathematical form of the MBWR is,

$$\begin{aligned}
 P = & \rho RT \\
 & + \rho^2(G(1)T + G(2)T^{1/2} + G(3) + G(4)/T + G(5)/T^2) \\
 & + \rho^3(G(6)T + G(7) + G(8)/T + G(9)/T^2) \\
 & + \rho^4(G(10)T + G(11) + G(12)/T) + \rho^5(G(13)) \\
 & + \rho^6(G(14)/T + G(15)/T^2) + \rho^7(G(16)/T) \\
 & + \rho^8(G(17)/T + G(18)T^2) + \rho^9(G(19)/T^2) \\
 & + \rho^3(G(20)/T^2 + G(21)/T^3) \exp(\gamma\rho^2) \\
 & + \rho^5(G(22)/T^2 + G(23)/T^4) \exp(\gamma\rho^2) \\
 & + \rho^7(G(24)/T^2 + G(25)/T^3) \exp(\gamma\rho^2) \\
 & + \rho^9(G(26)/T^2 + G(27)/T^4) \exp(\gamma\rho^2) \\
 & + \rho^{11}(G(28)/T^2 + G(29)/T^3) \exp(\gamma\rho^2) \\
 & + \rho^{13}(G(30)/T^2 + G(31)/T^3 + G(32)/T^4) \exp(\gamma\rho^2).
 \end{aligned} \quad (1)$$

¹Figures in brackets indicate literature references.

The nonlinear coefficient gamma, is defined generally as $\gamma = -1/\rho_c^2$, and is held constant during the fitting process to determine the linear coefficients $G(i)$.

Coefficients for each of the fluids are given in appendix L. Maximum temperatures and pressures, beyond which extrapolation is not advised, for these surfaces are given in appendix C.

2.2. Two-Phase Boundaries

2.2.1. Vapor Pressure

The temperature of the liquid-vapor boundary for each isobar in the tables is computed from a vapor pressure equation,

$$\ln P = \ln P_t + V_p(1)x + V_p(2)x^2 + V_p(3)x^3 + V_p(4)x^4 + V_p(5)x(1-x)^{V_p(6)} \quad (2)$$

where

$$x = (1-T_v/T)/(1-T_v/T_c) \quad (3)$$

2.2.2. Vapor Densities at Coexistence

Densities of the vapor at coexistence with liquid, which are used to generate all the saturated densities given in the tables, are given by

$$\rho = \rho_c + (\rho_v - \rho_c) \exp\{f(T)\} \quad (4)$$

and

$$f(T) = A(1) \ln x + \sum_{i=2}^4 A(i)(1-x)^{(i-5)/3} + \sum_{i=5}^{13} A(i)(1-x)^{(i-4)/3} \quad (5)$$

where

$$x = (T-T_c)/(T_t-T_c) \quad (6)$$

2.2.3. Liquid Densities at Coexistence

The liquid density at coexistence is calculated from,

$$\rho = \rho_c + (\rho_l - \rho_c) \exp\{f(T)\} \quad (7)$$

and

$$f(T) = A(14) \ln x + \sum_{i=15}^{17} A(i)(1-x)^{(i-18)/3} + \sum_{i=18}^{20} A(i)(1-x)^{(i-17)/3} \quad (8)$$

where x is defined in equation 6.

2.2.4. The Melting Line

The pressures at melting are given by,

$$P = A + BT^C \quad (9)$$

2.3. Derived Thermodynamic Properties

The properties derived from the equation of state and ideal gas heat capacity are entropy, enthalpy, internal energy, specific heat at constant volume and at constant pressure, and sound velocity.

2.3.1. Entropy

The entropy is computed from

$$S(T, \rho) = S^\circ(298.15) + \int_{298.15}^T \{C_p^\circ/T\} - R \ln(R T \rho / P_0) + \int_0^\rho \left\{ R / \rho (1/\rho^2) \left(\frac{\partial P}{\partial T} \right)_\rho \right\}_T d\rho \quad (10)$$

2.3.2. Ideal Gas Specific Heat

The ideal gas specific heat, C_p° is computed from the following,

$$C_p^\circ/R = G_i(1)/T^3 + G_i(2)/T^2 + G_i(3)/T + G_i(4) + G_i(5)T + G_i(6)T^2 + G_i(7)T^3 + G_i(8)u^2 e^u / (e^u - 1)^2 \quad (11)$$

where,

$$u = G_i(9)/T \quad (12)$$

2.3.3. Reference State

The reference states S° and H° at $T = 298.15$ K (given below in table 1) are from Wagman et al. [11], except for parahydrogen which is taken from Woolley, Scott, and Brickwedde [12], since reference [12], since reference [11] gives only the normal hydrogen values.

TABLE 1. Reference values for temperature, entropy, and enthalpy. The reference value for temperature is 298.15 K for all fluids. Values of S° and H° are from NBS TN 270-3 [11], except hydrogen [12].

	S° J/mol-K	H° J/mol
Argon	154.7335	6169.5
Ethylene	219.451	10564.6
Parahydrogen	130.407	8409.8
Nitrogen	191.502	8669.0
Nitrogen trifluoride	260.621	11828.0
Oxygen	205.029	8680.1

2.3.4. Enthalpy

The enthalpy is computed from

$$H(T,\rho) = H^\circ(T^\circ) + (P - \rho RT)/\rho + \int_0^\rho \left\{ \frac{P}{\rho^2} - \frac{T}{\rho^2} \left(\frac{\partial P}{\partial T} \right)_\rho \right\}_T d\rho + \int_{298.15}^T C_p dT. \quad (13)$$

2.3.5. Internal Energy

The internal energy is,

$$E(T,\rho) = H(T,\rho) - P/\rho. \quad (14)$$

2.3.6. Specific Heat at Constant Volume

The specific heat at constant volume is,

$$C_v(T,\rho) = C_p - R \int_0^\rho \left\{ \frac{T}{\rho^2} \left(\frac{\partial^2 P}{\partial T^2} \right)_\rho \right\}_T d\rho. \quad (15)$$

2.3.7. Specific Heat at Constant Pressure

The specific heat at constant pressure is,

$$C_p(T,\rho) = C_v(T,\rho) + + \left\{ \left(\frac{T}{\rho^2} \right) \left(\frac{\partial P}{\partial T} \right)_\rho^2 / \left(\frac{\partial^2 P}{\partial \rho} \right)_T \right\}. \quad (16)$$

2.3.8. Sound Velocity

From this the sound velocity can be computed as,

$$W(T,\rho) = \left\{ \frac{C_p}{C_v} \left(\frac{\partial P}{\partial \rho} \right)_T \right\}^{1/2}. \quad (17)$$

of the relations used here are from the work of Hanley, McCarty, and Haynes [13]. The functional forms for viscosity and thermal conductivity are,

$$\eta = \eta_0(T) + \eta_1(T)\rho + \eta_2(\rho,T) \quad (18)$$

and

$$\lambda = \lambda_0(T) + \lambda_1(T)\rho + \lambda_2(\rho,T) + \lambda_c(\rho,T). \quad (19)$$

The first terms of eqs (18) and (19) are the contributions of the dilute gas,

$$\eta_0(T) = \sum_{i=1}^9 G_v(i) T^{(4-i)/3} \quad (20)$$

and

$$\lambda_0(T) = \sum_{i=1}^9 G_t(i) T^{(4-i)/3}.$$

The second terms in eqs (18) and (19) represent the contribution to the transport coefficients of the moderately dense gas.

$$\eta_1(T) = F_v(1) + F_v(2) \{F_v(3) - \ln(T/F_v(4))\}^2$$

and

$$\lambda_1(T) = F_t(1) + F_t(2) \{F_t(3) - \ln(T/F_t(4))\}^2.$$

The third terms in these equations are the contribution of the dense gas,

$$\eta_2(\rho,T) = \exp\{F(\rho,T)\} - \exp\{G(T)\} \quad (22)$$

$$F(\rho,T) = E_v(1) + E_v(2)H(\rho) + E_v(3)\rho^{0.1} + + E_v(4)H(\rho)/T^2 + E_v(5)\rho^{0.1}/T^{1.5} + E_v(6)/T + E_v(7)H(\rho)/T \quad (23)$$

$$G(T) = E_v(1) + E_v(2)/T \quad (24)$$

where

$$H(\rho) = \rho^{0.5} (\rho - E_v(8))/E_v(8). \quad (25)$$

The functional form of eqs (22), (23), (24), and (25) is used for the corresponding thermal conductivity equations with the coefficients E_v substituted for the E 's.

The last term of eq. 19 is the critical enhancement term and is described in appendix D. Critical effects can be very large, especially in the range $(\rho - \rho_c)/\rho < 0.25$ and $(T - T_c)/T < 0.025$ and in fact, as the critical point is approached, this term may be larger than the sum of the other terms by several orders of magnitude. We include λ_c to give the proper behavior in the critical region and to produce a smooth transition from outside the critical to within it.

3. Transport Properties: Viscosity and Thermal Conductivity

Viscosity and thermal conductivity are given for argon, nitrogen, and oxygen. The theory and discussion

4. Dielectric Constant

The equation used to represent the dielectric constant is,

$$C_m = A + B\rho + C\rho^2 + D\rho^3 + ET + FP \quad (26)$$

where,

$$C_m = \left\{ \frac{\epsilon - 1}{\epsilon + 2} \right\} / \rho \quad (27)$$

Equation 27 is the well-known Clausius-Mossotti relation. Coefficients are given for parahydrogen, nitrogen, and oxygen. The coefficients of Stewart [14] for parahydrogen were modified to conform to eq. (27). The data of Ely and Straty for nitrogen [15] were used in a fit of eq. (27). The oxygen coefficients are from Younglove [16].

Although the range of the Clausius-Mossotti function for most liquids is small, the very high precision of the data requires the terms of eq. (27). The temperature and pressure terms are useful in fitting the compressed liquid states. The pressure term allows the flexibility which is useful in fluids with low compressibilities, usually found at low temperatures and high pressures [17].

5. Summary of Uncertainties

The following uncertainties are taken primarily from the source documents and from [2]. The basic references for each of the fluids should be referred to for comparisons of the mathematical representations to the experimental data. These uncertainties are based on the authors claims for accuracies of the experimental data, and the inaccuracies introduced in fitting the data. They are maximum deviations and in most cases deviations are substantially less. Figure 1 shows the regions indicated for fluid, gas, and liquid.

We stress that the uncertainties in table 2, for the various properties, are not intended to represent the critical region, which we assess to be $\rho_c \pm 0.3 \rho_c$ and $T_c \pm 0.05 T_c$. However, for practical calculation the MBWR equation may be used in this region to compute properties with the understanding that the uncertainties

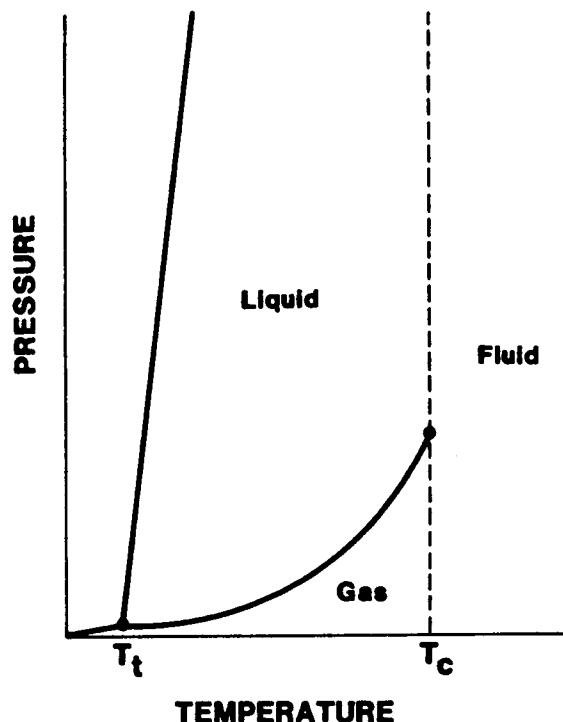


FIG. 1. Regions for associated uncertainties. (See table 2).

will be larger since this equation has not been adapted to produce the proper behavior near the critical point.

Uncertainties for nitrogen trifluoride were not indicated in reference [9], because of the sole source nature of the data. However, based on our experience, the maximum deviations arising from the fitting uncertainties and experimental data uncertainties are probably no greater than those shown for argon.

6. Units

Except as noted, all numerical constants listed in appendices F through L are consistent with the units for the various properties given in appendix A. As stated in the appendices, the densities for viscosity and thermal conductivity calculations must be supplied in units of grams per cubic centimeter.

THERMOPHYSICAL PROPERTIES OF FLUIDS

TABLE 2. Uncertainties in calculated properties. Maximum deviations of properties in percent^a

Property	Liquid below T_c	Gas below T_c	Fluid above T_c
Argon and Nitrogen Trifluoride			
Pressure %	10.	0.3	0.3
Density %	0.25	0.3	0.3
Temperature %	0.25	0.3	0.3
Enthalpy (J/mol)	2.0	1.0	1.5
Entropy %	1.0	1.0	1.0
Specific heat ($P = \text{constant}$) %	5.0	5.0	5.0
Specific heat ($V = \text{constant}$) %	5.0	5.0	5.0
Speed of sound %	5.0	5.0	5.0
Thermal conductivity %	4.0	4.0	6.0
Viscosity %	2.0	2.0	2.0
Ethylene			
Pressure %	5.0	0.25	0.2
Density %	0.3	0.3	0.3
Temperature %	0.1	0.2	0.2
Enthalpy (J/mol)	2.0	2.0	2.0
Entropy %	2.0	1.0	1.0
Specific heat ($P = \text{constant}$) %	5.0	5.0	5.0
Specific heat ($V = \text{constant}$) %	5.0	5.0	5.0
Speed of sound %	5.0	5.0	5.0
para Hydrogen			
Pressure %	5.0	0.25	0.2
Density %	0.1	0.25	0.2
Temperature %	0.1	0.25	0.2
Enthalpy (J/mol)	1	3	5.1
Entropy %	1.0	1.0	1.0
Specific heat ($P = \text{constant}$) %	3.0	2.0	3.0
Specific heat ($V = \text{constant}$) %	3.0	2.0	3.0
Speed of sound %	2.0	1.0	1.0
Nitrogen			
Pressure %	5.0	0.3	0.3
Density %	0.5	0.3	0.2
Temperature %	0.5	0.3	0.2
Enthalpy (J/mol)	3	1	1
Entropy %	2.0	1.0	1.0
Specific heat ($P = \text{constant}$) %	5.0	5.0	5.0
Specific heat ($V = \text{constant}$) %	5.0	5.0	5.0
Speed of sound %	2.0	0.25	1.0
Thermal conductivity %	4.0	4.0	6.0
Viscosity %	2.0	2.0	6.0
Dielectric constant %	0.01	0.01	0.01
Oxygen			
Pressure %	5.0	0.25	0.15
Density %	0.1	0.25	0.15
Temperature %	0.1	0.2	0.1
Enthalpy (J/mol)	0.5	0.25	0.5
Entropy %	0.5	0.25	0.5
Specific heat ($P = \text{constant}$) %	3.0	5.0	3.0
Specific heat ($V = \text{constant}$) %	3.0	5.0	3.0
Speed of sound %	2.0	0.5	0.5
Thermal conductivity %	4.0	4.0	6.0
Viscosity %	2.0	2.0	2.0
Dielectric constant %	0.01	0.01	0.01

^aAll uncertainties are in percent except those for enthalpy, which are given in J/mol.

7. Acknowledgements

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Appendix A. List of Symbols and Units

Primary Thermophysical Quantities

P, P_c, P_t	pressure, P at critical point, P at triple point, MPa
ρ, ρ_c	density, ρ at critical point, mol/dm ³
ρ_{tr}, ρ_{tv}	ρ of liquid at triple point, ρ of gas at triple point
T, T_c, T_t	temperature, T at critical point, T at triple point, K
C_p, C_p^*	specific heat at constant pressure, C_p of ideal gas, J/mol·K
C_v, C_v^*	specific heat at constant volume, C_v for ideal gas, J/mol·K
E	internal energy, J/mol
H, H°	enthalpy, reference value of H , J/mol
S, S°	entropy, reference value of S , J/mol·K
W	sound velocity, m/s
η	viscosity, μ Pa·s
λ	thermal conductivity, W/m·K
ϵ	dielectric constant

Other Variables and Constants

R	the gas constant, 8.31434 J/mol·K
K_t	isothermal bulk modulus, (MPa) ⁻¹
M	molecular weight, g/mol
N_A	Avogadro's number, mol ⁻¹
C_m	Clausius-Mossotti function
T_0	reference temperature, 298.15 K

Appendix B. Conversion Factors

	From	To	Multiplied by
Pressure	MPa	psia	145.03774
Temperature	K	R	1.8
Density	mol/dm ³	lb/ft ³	0.0624280·M,
Internal energy	J/mol	BTU/lb	0.43021035·M,
Enthalpy	J/mol	BTU/lb	0.43021035·M,
Entropy	J/mol·K	BTU/lb·R	0.23900575·M,
Specific heat	J/mol·K	BTU/lb·R	0.23900575·M,
Thermal conductivity	W/m·K	BTU/ft·h·R	0.57817602
Viscosity	Pa·s	lb/ft·s	0.6719690
Velocity of sound	m/s	ft/s	3.28084
M, for	Argon		39.948
	Ethylene		28.054
	Hydrogen		2.01594
	Nitrogen		28.013
	Nitrogen trifluoride		71.019
	Oxygen		31.9988

M, is molecular weight [18].

lb is pound mass.

Appendix D. Critical Point Enhancement to Thermal Conductivity

The last term of eq. (19) is the contribution from critical point effects [13].

$$\Delta\lambda_c = \Delta\lambda' \exp \left\{ -18.66 \left(\frac{\rho - \rho_c}{\rho_c} \right)^4 - 4.25 \left(\frac{T - T_c}{T_c} \right)^2 \right\} \quad (D1)$$

where

$$\Delta\lambda' = \left\{ K_T^2 \left(\frac{\partial P}{\partial T} \right)_\rho K_T^{-1/2} Y \right\} 10^{-5} \quad (D2)$$

and

$$Y = \{6\pi\eta l(kT)^{1/2} \rho^{1/2} (N_A/M)^{1/2}\}^{-1} \quad (D3)$$

Here K_T is isothermal compressibility, and l represents a length approximating the hard sphere diameter of the molecule,

$$l = \{Fy_m^5 \rho(N_A/M, (\epsilon/k)/T^{1/2})\} \quad (D4)$$

where ϵ is the intermolecular potential at minimum, at which the molecular separation is r_m , and F is a parameter depending on the potential function.

The compressibility is computed from the MBWR surface unless the density is within 25 percent of the critical density and the temperature is within 2.5 percent of the critical temperature, in which case the compressibility is computed from a special scaled equation of state. Also note that the critical point of the scaled equation may be slightly different from that of the corresponding MBWR.

The reduced parameters used are,

$$\begin{aligned} \Delta\rho &= |\rho - \rho_c|/\rho_c \\ \Delta T &= |T - T_c|/T_c \\ \rho^* &= \rho/\rho_c \\ x &= \Delta T/(\Delta\rho)^{1/2} \\ K_T^* &= P_c K_t \end{aligned} \quad (D5)$$

The compressibility is computed from,

$$[\rho^{*2} K_T^*]^{-1} = \Delta\rho^{\delta-1} [\delta h(x) - (x/\beta)h'(x)] \quad (D6)$$

with

$$h(x) = E_1 \left(\frac{x+x_0}{x_0} \right)^{2\beta} \left[1 + E_1 \left(\frac{x+x_0}{x_c} \right)^{2\beta} \right]^{(\gamma-1)/2\beta} \quad (D7)$$

and

$$h'(x) = \frac{E_1}{x_0} \left[1 + E_2 \left(\frac{x+x_0}{x_0} \right)^{2\beta} \right]^{(\gamma-1)/2\beta} \quad (D8)$$

$$+ \frac{\gamma-1}{x_0} E_1 E_2 \left(\frac{x+x_0}{x_0} \right)^{2\beta} \left[1 + E_2 \left(\frac{x+x_0}{x_0} \right)^{2\beta} \right]^{(\gamma-1-2\beta)/2\beta}$$

Appendix C. Triple Point, Critical Point, Maximum Pressures, and Temperatures^a

Triple Point			
fluid	P _t (MPa)	ρ _t (mol/dm ³)	T _t (K)
Ar	0.68906 × 10 ⁻¹	35.400	0.10292
C ₂ H ₄	0.121295 × 10 ⁻³	23.343	0.142546 × 10 ⁻³
H ₂	0.7042 × 10 ⁻²	38.2143	0.632230 × 10 ⁻¹
N ₂	0.12463 × 10 ⁻¹	30.977	0.24282 × 10 ⁻¹
NF ₃	0.185425 × 10 ⁻⁶	26.320	0.33612 × 10 ⁻⁸
O ₂	0.14800 × 10 ⁻³	40.820	0.33189 × 10 ⁻³

Critical Point

fluid	P _c (MPa)	ρ _c (mol/dm ³)	T _c (K)
Ar	4.9058	13.41	150.86
C ₂ H ₄	5.0404	7.650	282.3428
H ₂	1.28377	15.556	32.938
N ₂	3.39908	11.21	126.26
NF ₃	4.4607	7.92	234.0
O ₂	5.043	13.630	154.581

Maximum Pressures and Temperatures^a

fluid	P _{max} (MPa)	T _{max} (K)
Ar	101	400
C ₂ H ₄	40	400
H ₂	121	400
N ₂	1013	1900
NF ₃	50	500
O ₂	121	400

^aThe extrapolation of the MBWR and associated equations beyond these values is not advised.

Values of the parameters used in the equations for critical enhancement are given below in table D1. Units for density when computing viscosity and thermal conductivity are g/cm³.

TABLE D1. Critical enhancement parameters [13,17]. When these numerical values are used in equations D1 through D4, the calculated values of $\Delta\lambda_c$ has units of W/(m·K).

	Argon	Nitrogen	Oxygen
ϵ/k (K)	52.8	118.	113.0
r_m (cm)	3.669×10^{-8}	3.933×10^{-8}	3.8896×10^{-8}
T_c (K)	150.725	126.24	154.575
ρ_c (g/cm ³)	0.533	0.3139	0.4362
F	1.7124	1.67108	2.210636
P_c (MPa)	4.8619	3.443	5.0429
x_0	0.183	0.164	0.183
β	0.355	0.355	0.355
δ	4.352	4.352	4.352
E_1	2.27	2.17	2.21
E_2	0.287	0.287	0.287
γ	1.190	1.190	1.190

Appendix E. Summary of Basic Equations

1. The modified Benedict-Webb-Rubin equation of state:

$$\begin{aligned}
 P = & \rho RT \\
 & + \rho^2(G(1)T + G(2)T^{1/2} + G(3) + G(4)/T + G(5)/T^2) \\
 & + \rho^3(G(6)T + G(7) + G(8)/T + G(9)/T^2) \\
 & + \rho^4(G(10)T + G(11) + G(12)/T) + \rho^5(G(13)) \\
 & + \rho^6(G(14)/T + G(15)/T^2) + \rho^7(G(16)/T) \\
 & + \rho^8(G(17)/T + G(18)T^2) + \rho^9(G(19)/T^2) \\
 & + \rho^{10}(G(20)/T^2 + G(21)/T^3) \exp(\gamma\rho^2) \\
 & + \rho^{11}(G(22)/T^2 + G(23)/T^4) \exp(\gamma\rho^2) \\
 & + \rho^{12}(G(24)/T^2 + G(25)/T^3) \exp(\gamma\rho^2) \\
 & + \rho^{13}(G(26)/T^2 + G(27)/T^4) \exp(\gamma\rho^2) \\
 & + \rho^{14}(G(28)/T^2 + G(29)/T^3) \exp(\gamma\rho^2) \\
 & + \rho^{15}(G(30)/T^2 + G(31)/T^3 + G(32)/T^4) \exp(\gamma\rho^2). \tag{1}
 \end{aligned}$$

2. The vapor pressure:

$$\begin{aligned}
 \ln P = & \ln P_t + V_p(1)x + V_p(2)x^2 + V_p(3)x^3 \\
 & + V_p(4)x^4 + V_p(5)x(1-x)^{V_p(6)} \tag{2}
 \end{aligned}$$

$$x = (1-T_t/T)/(1-T_t/T_c). \tag{3}$$

3. The vapor densities at coexistence:

$$\rho = \rho_c + (\rho_{tv} - \rho_c) \exp\{f(T)\} \tag{4}$$

$$\begin{aligned}
 f(T) = & A(1) \ln x + \sum_{i=2}^4 A(i)(1-x^{(i-5)/3}) \\
 & + \sum_{i=5}^{13} A(i)(1-x)^{(i-4)/3} \tag{5}
 \end{aligned}$$

$$x = (T-T_c)/(T_t-T_c). \tag{6}$$

4. The liquid densities at coexistence:

$$\rho = \rho_c + (\rho_{tl} - \rho_c) \exp\{f(T)\} \tag{7}$$

$$\begin{aligned}
 f(T) = & A(14) \ln x + \sum_{i=15}^{17} A(i)(1-x^{(i-18)/3}) \\
 & + \sum_{i=18}^{20} A(i)(1-x^{(i-17)/3}). \tag{8}
 \end{aligned}$$

5. The melting line:

$$P = A + BT^C. \tag{9}$$

6. The viscosity:

$$\eta = \eta_0(T) + \eta_1(T)\rho + \eta_2(\rho, T). \tag{18}$$

7. The thermal conductivity:

$$\lambda = \lambda_0(T) + \lambda_1(T)\rho + \lambda_2(\rho, T) + \lambda_c(\rho, T). \tag{19}$$

8. The dielectric constant:

$$C_m = \left\{ \frac{\epsilon - 1}{\epsilon + 2} \right\} / \rho \tag{27}$$

$$C_m = A + B\rho + C\rho^2 + D\rho^3 + ET + FP. \tag{26}$$

Appendix H. Thermophysical Properties of Hydrogen

Thermophysical properties of coexisting gaseous and liquid hydrogen

T K	Pres. MPa	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
13.800*	.00704	77.04	38.21	-622.6	-622.4	10.00	10.97	15.56	1376.0	1.25164
13.800*	.00704	.1275	.06322	169.6	281.0	75.45	12.74	21.53	305.0	1.00039
14.0	.00790	76.87	38.13	-619.5	-619.3	10.22	10.58	15.17	1367.0	1.25105
14.0	.00790	.1404	.06967	171.8	285.1	74.82	12.75	21.57	307.0	1.00042
14.5	.01038	76.44	37.92	-612.1	-611.8	10.74	9.95	14.57	1343.0	1.24955
14.5	.01038	.1778	.08820	177.3	295.0	73.28	12.79	21.70	311.8	1.00054
15.0	.01343	76.01	37.70	-604.9	-604.6	11.23	9.65	14.37	1319.0	1.24803
15.0	.01343	.2226	.1104	182.7	304.3	71.82	12.83	21.85	316.4	1.00067
15.5	.01712	75.57	37.49	-597.7	-597.3	11.70	9.58	14.45	1295.0	1.24648
15.5	.01712	.2756	.1367	187.9	313.1	70.44	12.86	22.02	320.8	1.00083
16.0	.02153	75.12	37.26	-590.5	-589.9	12.16	9.65	14.71	1272.0	1.24491
16.0	.02153	.3374	.1674	193.0	321.7	69.14	12.91	22.20	325.1	1.00102
16.5	.02674	74.66	37.04	-583.0	-582.3	12.62	9.80	15.09	1249.0	1.24330
16.5	.02674	.4087	.2028	198.0	329.8	67.90	12.95	22.40	329.1	1.00123
17.0	.03284	74.19	36.80	-575.4	-574.5	13.08	10.00	15.56	1227.0	1.24165
17.0	.03284	.4904	.2433	202.8	337.8	66.74	12.99	22.62	333.0	1.00148
17.5	.03992	73.71	36.56	-567.6	-566.5	13.53	10.23	16.08	1206.0	1.23997
17.5	.03992	.5831	.2892	207.4	345.4	65.64	13.04	22.86	336.7	1.00176
18.0	.04808	73.22	36.32	-559.4	-558.1	13.99	10.46	16.64	1185.0	1.23825
18.0	.04808	.6877	.3411	211.8	352.8	64.59	13.08	23.12	340.2	1.00207
18.5	.05739	72.71	36.07	-551.0	-549.4	14.45	10.69	17.23	1166.0	1.23649
18.5	.05739	.8051	.3994	216.1	359.8	63.60	13.13	23.41	343.6	1.00243
19.0	.06796	72.19	35.81	-542.4	-540.5	14.91	10.92	17.84	1147.0	1.23468
19.0	.06796	.9361	.4644	220.1	366.5	62.65	13.18	23.72	346.7	1.00282
19.5	.07989	71.66	35.55	-533.4	-531.2	15.38	11.13	18.47	1129.0	1.23281
19.5	.07989	1.082	.5366	224.0	372.9	61.74	13.23	24.07	349.7	1.00326
20.0	.09326	71.11	35.27	-524.1	-521.5	15.85	11.32	19.12	1111.0	1.23090
20.0	.09326	1.243	.6166	227.6	378.8	60.87	13.28	24.45	352.6	1.00375
20.5	.1082	70.54	34.99	-514.6	-511.5	16.32	11.51	19.79	1093.0	1.22893
20.5	.1082	1.421	.7049	230.9	384.4	60.02	13.34	24.87	355.2	1.00429
21.0	.1247	69.96	34.70	-504.7	-501.1	16.80	11.68	20.48	1075.0	1.22690
21.0	.1247	1.617	.8020	234.0	389.5	59.21	13.39	25.33	357.7	1.00488
21.5	.1431	69.35	34.40	-494.6	-490.4	17.28	11.83	21.19	1057.0	1.22480
21.5	.1431	1.832	.9087	236.9	394.4	58.43	13.45	25.84	360.1	1.00553
22.0	.1632	68.73	34.09	-484.1	-479.3	17.76	11.98	21.93	1038.0	1.22264
22.0	.1632	2.067	1.025	239.4	398.5	57.66	13.52	26.40	362.2	1.00624
22.5	.1853	68.08	33.77	-473.3	-467.8	18.25	12.11	22.71	1020.0	1.22041
22.5	.1853	2.325	1.153	241.6	402.3	56.92	13.58	27.03	364.3	1.00702
23.0	.2094	67.42	33.44	-462.1	-455.8	18.74	12.23	23.53	1001.0	1.21809
23.0	.2094	2.606	1.293	243.5	405.5	56.19	13.65	27.73	366.1	1.00787
23.5	.2357	66.72	33.10	-450.6	-443.5	19.24	12.35	24.41	981.2	1.21570
23.5	.2357	2.912	1.445	245.0	408.2	55.48	13.72	28.51	367.8	1.00880
24.0	.2642	66.00	32.74	-438.7	-430.7	19.75	12.46	25.34	961.2	1.21321
24.0	.2642	3.246	1.610	246.1	410.2	54.78	13.80	29.38	369.3	1.00982
24.5	.2951	65.25	32.37	-426.5	-417.3	20.26	12.56	26.36	940.6	1.21063
24.5	.2951	3.610	1.791	246.8	411.7	54.09	13.88	30.37	370.7	1.01092
25.0	.3285	64.47	31.98	-413.8	-403.5	20.77	12.65	27.46	919.3	1.20794
25.0	.3285	4.006	1.987	247.1	412.4	53.40	13.97	31.50	371.9	1.01212
25.5	.3643	63.66	31.58	-400.7	-389.2	21.29	12.75	28.67	897.2	1.20515
25.5	.3643	4.437	2.201	246.9	412.4	52.73	14.07	32.79	373.0	1.01343

Thermophysical properties of coexisting gaseous and liquid hydrogen—Continued

T K	Pres. MPa	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
26.0	.4029	62.80	31.15	-387.2	-374.3	21.83	12.84	30.02	874.4	1.20222
26.0	.4029	4.907	2.434	246.1	411.6	52.05	14.17	34.27	373.9	1.01486
26.5	.4443	61.91	30.71	-373.2	-358.7	22.37	12.93	31.53	850.8	1.19916
26.5	.4443	5.421	2.689	244.8	410.0	51.37	14.28	35.99	374.7	1.01643
27.0	.4885	60.97	30.24	-358.6	-342.5	22.92	13.02	33.25	826.2	1.19595
27.0	.4885	5.982	2.967	242.8	407.4	50.69	14.40	38.03	375.3	1.01814
27.5	.5357	59.98	29.75	-343.5	-325.4	23.49	13.12	35.24	800.6	1.19257
27.5	.5357	6.598	3.273	240.0	403.7	50.00	14.52	40.45	375.7	1.02002
28.0	.5861	58.93	29.23	-327.7	-307.6	24.07	13.22	37.58	774.0	1.18899
28.0	.5861	7.276	3.609	236.5	398.9	49.29	14.66	43.38	376.0	1.02210
28.5	.6397	57.80	28.67	-311.1	-288.8	24.67	13.33	40.39	746.1	1.18517
28.5	.6397	8.026	3.981	232.0	392.6	48.57	14.82	47.00	376.2	1.02439
29.0	.6967	56.60	28.08	-293.7	-268.9	25.29	13.46	43.84	716.8	1.18109
29.0	.6967	8.860	4.395	226.3	384.8	47.83	14.98	51.58	376.2	1.02695
29.5	.7573	55.29	27.43	-275.3	-247.7	25.94	13.60	48.24	686.0	1.17667
29.5	.7573	9.797	4.860	219.4	375.2	47.05	15.17	57.55	376.0	1.02983
30.0	.8214	53.86	26.72	-255.6	-224.8	26.63	13.76	54.05	653.5	1.17185
30.0	.8214	10.86	5.387	210.8	363.2	46.23	15.38	65.64	375.7	1.03311
30.5	.8895	52.27	25.93	-234.4	-200.1	27.36	13.96	62.18	619.0	1.16651
30.5	.8895	12.09	5.996	200.1	348.4	45.34	15.61	77.23	375.2	1.03690
31.0	.9615	50.48	25.04	-211.2	-172.8	28.16	14.19	74.37	582.4	1.16049
31.0	.9615	13.54	6.715	186.6	329.8	44.36	15.88	95.15	374.5	1.04139
31.5	1.038	48.39	24.00	-185.2	-141.9	29.05	14.49	94.71	543.4	1.15352
31.5	1.038	15.31	7.597	169.0	305.7	43.25	16.20	126.4	373.7	1.04692
32.0	1.119	45.74	22.69	-153.9	-104.6	30.11	14.91	138.5	499.4	1.14472
32.0	1.119	17.65	8.754	144.8	272.6	41.90	16.57	194.1	372.8	1.05420
32.5	1.204	38.55	19.12	-80.7	-17.7	32.67	16.29	2151.0	407.9	1.12105
32.5	1.204	24.50	12.16	65.3	164.4	38.28	17.48	7867.0	367.6	1.07581
32.94 ^b	1.283	31.36	15.56	-3.3	79.2	35.49				1.09773

^aTriple point.^bCritical point.

Thermophysical properties of hydrogen on the melting line

T K	Pres. MPa	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
13.80*	.00704	77.04	38.21	-622.6	-622.4	10.00	10.97	15.56	1376.0	1.25164
15.0	3.737	78.91	39.14	-617.3	-521.8	10.29	10.60	13.49	1332.0	1.25823
15.5	5.396	79.76	39.56	-614.5	-478.1	10.39	10.31	13.03	1356.0	1.26124
16.0	7.112	80.61	39.99	-611.6	-433.7	10.47	10.04	12.75	1393.0	1.26424
16.5	8.883	81.44	40.40	-608.4	-388.5	10.54	9.84	12.61	1439.0	1.26718
17.0	10.71	82.25	40.80	-605.1	-342.6	10.60	9.73	12.60	1490.0	1.27004
17.5	12.58	83.02	41.18	-601.5	-296.0	10.65	9.70	12.68	1541.0	1.27281
18.0	14.51	83.77	41.56	-597.8	-248.6	10.69	9.75	12.83	1591.0	1.27548
18.5	16.49	84.50	41.91	-593.8	-200.4	10.74	9.87	13.03	1640.0	1.27805
19.0	18.51	85.20	42.26	-589.5	-151.5	10.78	10.03	13.24	1685.0	1.28055
19.5	20.59	85.87	42.60	-585.0	-101.7	10.83	10.22	13.47	1728.0	1.28296
20.0	22.71	86.53	42.92	-580.2	-51.2	10.88	10.44	13.70	1767.0	1.28531
20.5	24.87	87.17	43.24	-575.0	.2	10.93	10.67	13.92	1805.0	1.28760
21.0	27.08	87.79	43.55	-569.6	52.3	10.99	10.90	14.13	1839.0	1.28984
21.5	29.34	88.41	43.85	-563.8	105.2	11.05	11.14	14.33	1872.0	1.29204
22.0	31.64	89.01	44.15	-557.7	158.9	11.11	11.37	14.51	1903.0	1.29419
22.5	33.98	89.60	44.44	-551.2	213.3	11.18	11.60	14.68	1932.0	1.29632
23.0	36.36	90.18	44.73	-544.5	268.4	11.26	11.81	14.84	1960.0	1.29841
23.5	38.79	90.75	45.02	-537.4	324.3	11.33	12.02	14.97	1987.0	1.30048
24.0	41.26	91.32	45.30	-530.0	380.8	11.41	12.21	15.10	2013.0	1.30253
24.5	43.77	91.89	45.58	-522.3	438.1	11.49	12.39	15.21	2038.0	1.30456
25.0	46.33	92.44	45.86	-514.2	496.0	11.58	12.56	15.31	2062.0	1.30657
25.5	48.92	92.99	46.13	-505.9	554.5	11.66	12.72	15.39	2085.0	1.30857
26.0	51.55	93.54	46.40	-497.3	613.6	11.75	12.86	15.47	2108.0	1.31055
26.5	54.22	94.09	46.67	-488.4	673.3	11.84	13.00	15.54	2129.0	1.31252
27.0	56.93	94.63	46.94	-479.2	733.5	11.93	13.12	15.60	2150.0	1.31448
27.5	59.67	95.16	47.21	-469.7	794.3	12.02	13.23	15.66	2171.0	1.31643
28.0	62.46	95.70	47.47	-460.0	855.7	12.11	13.33	15.71	2191.0	1.31838
28.5	65.28	96.23	47.74	-450.0	917.6	12.20	13.42	15.75	2210.0	1.32032
29.0	68.14	96.77	48.00	-439.7	979.9	12.29	13.51	15.79	2229.0	1.32226
29.5	71.04	97.30	48.26	-429.1	1043.0	12.38	13.59	15.83	2247.0	1.32419
30.0	73.98	97.83	48.53	-418.3	1106.0	12.47	13.66	15.87	2265.0	1.32612
30.5	76.95	98.35	48.79	-407.3	1170.0	12.56	13.72	15.90	2282.0	1.32805
31.0	79.97	98.88	49.05	-396.0	1234.0	12.64	13.78	15.93	2298.0	1.32998
31.5	83.02	99.41	49.31	-384.5	1299.0	12.73	13.83	15.97	2314.0	1.33190
32.0	86.10	99.94	49.57	-372.7	1364.0	12.82	13.88	16.00	2330.0	1.33383
32.5	89.23	100.5	49.84	-360.7	1430.0	12.90	13.93	16.04	2344.0	1.33577
33.0	92.39	101.0	50.10	-348.5	1496.0	12.98	13.97	16.08	2358.0	1.33770
33.5	95.59	101.5	50.36	-336.1	1562.0	13.06	14.01	16.13	2372.0	1.33964
34.0	98.82	102.1	50.62	-323.4	1629.0	13.14	14.05	16.17	2385.0	1.34159
34.5	102.1	102.6	50.89	-310.6	1696.0	13.22	14.09	16.23	2397.0	1.34354
35.0	105.4	103.1	51.15	-297.5	1763.0	13.29	14.12	16.29	2408.0	1.34550
35.5	108.7	103.7	51.42	-284.2	1831.0	13.36	14.16	16.36	2419.0	1.34747
36.0	112.1	104.2	51.68	-270.7	1899.0	13.43	14.20	16.44	2429.0	1.34945
36.5	115.5	104.7	51.95	-257.0	1967.0	13.49	14.23	16.53	2439.0	1.35145
37.0	119.0	105.3	52.22	-243.1	2036.0	13.55	14.27	16.64	2447.0	1.35345

*Triple point.

B. A. YOUNGLOVE

Thermophysical properties of hydrogen

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
.005 MPa isobar									
14.0	.08755	.04343	173.1	288.2	78.79	12.64	21.27	308.2	1.00026
15.0	.08157	.04046	185.8	309.4	80.25	12.60	21.16	319.4	1.00025
16.0	.07636	.03788	198.5	330.5	81.61	12.56	21.08	330.2	1.00023
17.0	.07179	.03561	211.2	351.6	82.89	12.54	21.02	340.6	1.00022
18.0	.06774	.03360	223.8	372.6	84.09	12.52	20.98	350.6	1.00021
19.0	.06413	.03181	236.4	393.5	85.22	12.51	20.95	360.4	1.00019
20.0	.06089	.03020	248.9	414.5	86.30	12.50	20.93	369.9	1.00018
21.0	.05796	.02875	261.5	435.4	87.32	12.50	20.91	379.2	1.00018
22.0	.05530	.02743	274.0	456.3	88.29	12.49	20.89	388.2	1.00017
23.0	.05288	.02623	286.5	477.2	89.22	12.49	20.88	397.0	1.00016
24.0	.05066	.02513	299.1	498.0	90.11	12.48	20.87	405.6	1.00015
26.0	.04674	.02318	324.1	539.8	91.78	12.48	20.85	422.3	1.00014
28.0	.04338	.02152	349.1	581.4	93.32	12.48	20.84	438.3	1.00013
30.0	.04048	.02008	374.1	623.1	94.76	12.48	20.83	453.8	1.00012
32.0	.03794	.01882	399.1	664.8	96.10	12.47	20.82	468.7	1.00012
34.0	.03570	.01771	424.1	706.4	97.36	12.47	20.82	483.2	1.00011
36.0	.03371	.01672	449.0	748.0	98.55	12.47	20.82	497.3	1.00010
38.0	.03193	.01584	474.0	789.7	99.68	12.47	20.81	510.9	1.00010
40.0	.03033	.01505	499.0	831.3	100.7	12.48	20.82	524.1	1.00009
42.0	.02889	.01433	524.0	873.0	101.8	12.50	20.84	536.9	1.00009
44.0	.02757	.01368	549.0	914.7	102.7	12.53	20.86	549.3	1.00008
46.0	.02637	.01308	574.1	956.4	103.7	12.56	20.89	561.4	1.00008
48.0	.02527	.01254	599.3	998.2	104.6	12.59	20.92	573.2	1.00008
50.0	.02426	.01203	624.6	1040.0	105.4	12.64	20.97	584.7	1.00007
52.0	.02332	.01157	649.9	1082.0	106.2	12.69	21.02	595.7	1.00007
54.0	.02246	.01114	675.4	1124.0	107.0	12.76	21.09	606.4	1.00007
56.0	.02166	.01074	701.0	1166.0	107.8	12.85	21.17	616.8	1.00007
58.0	.02091	.01037	726.8	1209.0	108.5	12.95	21.28	626.7	1.00006
60.0	.02021	.01003	752.8	1252.0	109.3	13.07	21.40	636.2	1.00006
65.0	.01866	.009254	819.1	1359.0	111.0	13.47	21.79	658.5	1.00006
70.0	.01732	.008593	887.7	1470.0	112.6	13.98	22.30	678.6	1.00005
75.0	.01617	.008020	959.1	1583.0	114.2	14.60	22.92	696.8	1.00005
80.0	.01516	.007519	1034.0	1699.0	115.7	15.32	23.64	713.5	1.00005
85.0	.01426	.007076	1112.0	1819.0	117.1	16.10	24.42	729.1	1.00004
90.0	.01347	.006683	1195.0	1943.0	118.6	16.94	25.26	743.9	1.00004
95.0	.01276	.006331	1282.0	2072.0	119.9	17.81	26.13	758.1	1.00004
100.0	.01212	.006015	1373.0	2205.0	121.3	18.68	27.00	772.0	1.00004
105.0	.01155	.005728	1469.0	2342.0	122.6	19.54	27.86	785.7	1.00004
110.0	.01102	.005468	1569.0	2483.0	124.0	20.36	28.68	799.4	1.00003
115.0	.01054	.005230	1672.0	2628.0	125.3	21.13	29.45	813.0	1.00003
120.0	.01010	.005012	1780.0	2777.0	126.5	21.83	30.15	826.7	1.00003
125.0	.00970	.004812	1890.0	2930.0	127.8	22.45	30.77	840.6	1.00003
130.0	.00933	.004627	2004.0	3085.0	129.0	22.98	31.30	854.5	1.00003
140.0	.00866	.004296	2238.0	3402.0	131.3	23.82	32.14	882.6	1.00003
150.0	.00808	.004010	2479.0	3727.0	133.6	24.35	32.67	911.0	1.00003
160.0	.00758	.003759	2724.0	4055.0	135.7	24.62	32.93	939.6	1.00002
170.0	.00713	.003538	2971.0	4385.0	137.7	24.67	32.98	968.3	1.00002
180.0	.00674	.003342	3217.0	4714.0	139.6	24.56	32.88	996.9	1.00002
190.0	.00638	.003166	3462.0	5042.0	141.3	24.35	32.67	1025.0	1.00002
200.0	.00606	.003008	3704.0	5367.0	143.0	24.08	32.39	1053.0	1.00002
210.0	.00577	.002865	3943.0	5689.0	144.6	23.77	32.08	1081.0	1.00002
220.0	.00551	.002734	4179.0	6009.0	146.1	23.45	31.76	1109.0	1.00002
230.0	.00527	.002616	4412.0	6325.0	147.5	23.13	31.45	1136.0	1.00002
240.0	.00505	.002507	4642.0	6638.0	148.8	22.84	31.15	1162.0	1.00002
250.0	.00485	.002406	4869.0	6948.0	150.1	22.57	30.88	1188.0	1.00002
260.0	.00466	.002314	5094.0	7255.0	151.3	22.32	30.64	1213.0	1.00002
270.0	.00449	.002228	5316.0	7561.0	152.4	22.10	30.42	1238.0	1.00001
280.0	.00433	.002149	5536.0	7864.0	153.5	21.91	30.23	1262.0	1.00001
300.0	.00404	.002006	5971.0	8465.0	155.6	21.61	29.92	1309.0	1.00001
320.0	.00379	.001880	6401.0	9061.0	157.5	21.39	29.71	1354.0	1.00001
340.0	.00357	.001770	6827.0	9654.0	159.3	21.24	29.56	1397.0	1.00001

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
360.0	.00337	.001671	7251.0	10240.0	161.0	21.14	29.45	1438.0	1.00001
380.0	.00319	.001584	7673.0	10830.0	162.6	21.07	29.38	1478.0	1.00001
400.0	.00303	.001504	8094.0	11420.0	164.1	21.01	29.33	1517.0	1.00001
.01 MPa isobar									
13.80 ^a	77.04	38.21	-622.5	-622.2	10.01	10.96	15.55	1375.0	1.25163
14.430 ^b	76.50	37.95	-613.1	-612.9	10.67	10.01	14.62	1347.0	1.24976
14.430 ^b	.1721	.08537	176.5	293.7	73.50	12.78	21.68	311.1	1.00052
15.0	.1647	.08169	184.0	306.4	74.36	12.73	21.56	317.6	1.00050
16.0	.1539	.07636	196.9	327.8	75.75	12.66	21.39	328.7	1.00046
17.0	.1446	.07171	209.7	349.2	77.04	12.61	21.27	339.3	1.00044
18.0	.1363	.06760	222.5	370.4	78.25	12.58	21.19	349.5	1.00041
19.0	.1289	.06395	235.2	391.6	79.40	12.55	21.12	359.4	1.00039
20.0	.1223	.06068	247.8	412.7	80.48	12.54	21.07	369.0	1.00037
21.0	.1164	.05773	260.5	433.7	81.51	12.52	21.03	378.4	1.00035
22.0	.1110	.05506	273.1	454.7	82.48	12.51	21.00	387.5	1.00034
23.0	.1061	.05262	285.7	475.7	83.42	12.50	20.97	396.3	1.00032
24.0	.1016	.05040	298.2	496.7	84.31	12.50	20.95	405.0	1.00031
26.0	.09369	.04648	323.4	538.5	85.98	12.49	20.92	421.8	1.00028
28.0	.08693	.04312	348.4	580.3	87.53	12.48	20.89	437.9	1.00026
30.0	.08109	.04022	373.5	622.1	88.97	12.48	20.88	453.5	1.00025
32.0	.07598	.03769	398.5	663.8	90.32	12.48	20.86	468.4	1.00023
34.0	.07148	.03546	423.5	705.6	91.59	12.48	20.85	483.0	1.00022
36.0	.06749	.03348	448.5	747.2	92.78	12.48	20.84	497.1	1.00020
38.0	.06392	.03171	473.5	788.9	93.90	12.47	20.84	510.7	1.00019
40.0	.06071	.03012	498.5	830.6	94.97	12.48	20.84	524.0	1.00018
42.0	.05781	.02868	523.6	872.3	95.99	12.51	20.86	536.8	1.00018
44.0	.05517	.02737	548.6	914.0	96.96	12.53	20.88	549.2	1.00017
46.0	.05277	.02618	573.8	955.8	97.89	12.56	20.91	561.4	1.00016
48.0	.05056	.02508	599.0	997.7	98.78	12.60	20.94	573.1	1.00015
50.0	.04853	.02408	624.2	1040.0	99.64	12.64	20.98	584.6	1.00015
52.0	.04666	.02315	649.6	1082.0	100.5	12.69	21.03	595.7	1.00014
54.0	.04493	.02229	675.1	1124.0	101.3	12.76	21.10	606.4	1.00014
56.0	.04332	.02149	700.7	1166.0	102.0	12.85	21.18	616.7	1.00013
58.0	.04183	.02075	726.5	1208.0	102.8	12.95	21.29	626.7	1.00013
60.0	.04043	.02006	752.5	1251.0	103.5	13.07	21.41	636.2	1.00012
65.0	.03732	.01851	818.9	1359.0	105.2	13.47	21.80	658.5	1.00011
70.0	.03465	.01719	887.5	1469.0	106.9	13.98	22.31	678.6	1.00011
75.0	.03234	.01604	958.9	1582.0	108.4	14.60	22.93	696.8	1.00010
80.0	.03031	.01504	1034.0	1699.0	109.9	15.32	23.64	713.5	1.00009
85.0	.02853	.01415	1112.0	1819.0	111.4	16.10	24.43	729.1	1.00009
90.0	.02694	.01337	1195.0	1943.0	112.8	16.94	25.27	743.9	1.00008
95.0	.02552	.01266	1282.0	2072.0	114.2	17.81	26.13	758.2	1.00008
100.0	.02425	.01203	1373.0	2204.0	115.5	18.68	27.00	772.1	1.00007
105.0	.02309	.01146	1469.0	2342.0	116.9	19.54	27.86	785.8	1.00007
110.0	.02204	.01093	1568.0	2483.0	118.2	20.36	28.68	799.4	1.00007
115.0	.02108	.01046	1672.0	2628.0	119.5	21.13	29.45	813.0	1.00006
120.0	.02021	.01002	1780.0	2777.0	120.8	21.83	30.15	826.8	1.00006
125.0	.01940	.009623	1890.0	2930.0	122.0	22.45	30.77	840.6	1.00006
130.0	.01865	.009252	2004.0	3085.0	123.2	22.98	31.30	854.6	1.00006
140.0	.01732	.008592	2238.0	3402.0	125.6	23.82	32.14	882.6	1.00005
150.0	.01616	.008019	2479.0	3727.0	127.8	24.35	32.67	911.1	1.00005
160.0	.01515	.007518	2724.0	4055.0	129.9	24.62	32.93	939.6	1.00005
170.0	.01426	.007075	2971.0	4385.0	131.9	24.67	32.99	968.3	1.00004
180.0	.01347	.006682	3217.0	4714.0	133.8	24.56	32.88	996.9	1.00004
190.0	.01276	.006331	3462.0	5042.0	135.6	24.35	32.67	1025.0	1.00004
200.0	.01212	.006014	3704.0	5367.0	137.2	24.08	32.39	1054.0	1.00004
210.0	.01155	.005728	3943.0	5689.0	138.8	23.77	32.08	1081.0	1.00004
220.0	.01102	.005468	4179.0	6009.0	140.3	23.45	31.76	1109.0	1.00003
230.0	.01054	.005230	4412.0	6325.0	141.7	23.13	31.45	1136.0	1.00003
240.0	.01010	.005012	4642.0	6638.0	143.0	22.84	31.15	1162.0	1.00003
250.0	.00970	.004812	4869.0	6948.0	144.3	22.57	30.88	1188.0	1.00003

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol-K)	C _v J/(mol-K)	C _p J/(mol-K)	Sound m/s	Diel. const.
260.0	.00933	.004627	5094.0	7255.0	145.5	22.32	30.64	1213.0	1.00003
270.0	.00898	.004455	5316.0	7561.0	146.7	22.10	30.42	1238.0	1.00003
280.0	.00866	.004296	5536.0	7864.0	147.8	21.91	30.23	1262.0	1.00003
300.0	.00808	.004010	5971.0	8465.0	149.8	21.61	29.92	1309.0	1.00003
320.0	.00758	.003759	6401.0	9061.0	151.8	21.39	29.71	1354.0	1.00002
340.0	.00713	.003538	6827.0	9654.0	153.6	21.24	29.56	1397.0	1.00002
360.0	.00674	.003342	7251.0	10240.0	155.3	21.14	29.45	1438.0	1.00002
380.0	.00638	.003166	7673.0	10830.0	156.8	21.07	29.38	1479.0	1.00002
400.0	.00606	.003008	8093.0	11420.0	158.3	21.02	29.33	1517.0	1.00002
.02 MPa isobar									
13.81 ^a	77.04	38.22	-622.5	-622.0	10.01	10.96	15.54	1375.0	1.25165
14.0	76.88	38.13	-619.5	-619.0	10.22	10.59	15.17	1366.0	1.25107
15.0	76.01	37.70	-604.9	-604.4	11.23	9.65	14.37	1319.0	1.24803
15.836 ^b	75.27	37.34	-592.9	-592.3	12.01	9.62	14.61	1279.0	1.24543
15.836 ^b	.3162	.1568	191.4	318.9	69.55	12.89	22.14	323.7	1.00095
20.0	.2469	.1225	245.6	409.0	74.61	12.60	21.37	367.2	1.00075
21.0	.2346	.1164	258.5	430.3	75.65	12.58	21.29	376.8	1.00071
22.0	.2236	.1109	271.2	451.5	76.64	12.55	21.22	386.0	1.00067
23.0	.2135	.1059	283.9	472.7	77.58	12.54	21.16	395.1	1.00064
24.0	.2044	.1014	296.6	493.9	78.48	12.52	21.12	403.9	1.00062
26.0	.1883	.09339	321.9	536.0	80.16	12.51	21.05	420.9	1.00057
28.0	.1745	.08658	347.1	578.1	81.72	12.50	21.00	437.1	1.00053
30.0	.1627	.08071	372.3	620.1	83.17	12.49	20.97	452.8	1.00049
32.0	.1524	.07559	397.4	662.0	84.52	12.48	20.94	467.9	1.00046
34.0	.1433	.07109	422.5	703.8	85.79	12.48	20.92	482.5	1.00043
36.0	.1353	.06710	447.6	745.7	86.99	12.48	20.90	496.7	1.00041
38.0	.1281	.06353	472.6	787.4	88.12	12.48	20.89	510.4	1.00039
40.0	.1216	.06033	497.7	829.2	89.19	12.48	20.89	523.7	1.00037
42.0	.1158	.05743	522.7	871.0	90.21	12.51	20.90	536.6	1.00035
44.0	.1105	.05480	547.9	912.8	91.18	12.53	20.92	549.0	1.00033
46.0	.1056	.05240	573.0	954.7	92.11	12.56	20.94	561.2	1.00032
48.0	.1012	.05021	598.2	996.6	93.00	12.60	20.97	573.0	1.00031
50.0	.09715	.04819	623.5	1039.0	93.86	12.64	21.01	584.5	1.00029
52.0	.09339	.04633	648.9	1081.0	94.68	12.70	21.06	595.6	1.00028
54.0	.08992	.04461	674.4	1123.0	95.48	12.76	21.13	606.3	1.00027
56.0	.08670	.04301	700.1	1165.0	96.25	12.85	21.21	616.7	1.00026
58.0	.08370	.04152	725.9	1208.0	97.00	12.95	21.31	626.6	1.00025
60.0	.08090	.04013	752.0	1250.0	97.72	13.08	21.43	636.2	1.00024
65.0	.07466	.03703	818.4	1358.0	99.45	13.47	21.81	658.5	1.00023
70.0	.06931	.03438	887.0	1469.0	101.1	13.98	22.32	678.6	1.00021
75.0	.06468	.03209	958.5	1582.0	102.6	14.60	22.94	696.8	1.00020
80.0	.06063	.03008	1033.0	1698.0	104.1	15.32	23.65	713.6	1.00018
85.0	.05706	.02831	1112.0	1818.0	105.6	16.11	24.44	729.2	1.00017
90.0	.05389	.02673	1195.0	1943.0	107.0	16.94	25.27	744.0	1.00016
95.0	.05105	.02532	1281.0	2071.0	108.4	17.81	26.14	758.2	1.00015
100.0	.04850	.02406	1373.0	2204.0	109.8	18.68	27.01	772.1	1.00015
105.0	.04619	.02291	1468.0	2341.0	111.1	19.54	27.87	785.8	1.00014
110.0	.04408	.02187	1568.0	2483.0	112.4	20.36	28.69	799.5	1.00013
115.0	.04217	.02092	1672.0	2628.0	113.7	21.13	29.46	813.1	1.00013
120.0	.04041	.02005	1779.0	2777.0	115.0	21.83	30.15	826.8	1.00012
125.0	.03879	.01924	1890.0	2930.0	116.2	22.45	30.77	840.7	1.00012
130.0	.03730	.01850	2004.0	3085.0	117.5	22.98	31.30	854.6	1.00011
140.0	.03464	.01718	2238.0	3402.0	119.8	23.82	32.14	882.7	1.00011
150.0	.03233	.01604	2479.0	3726.0	122.0	24.35	32.67	911.2	1.00010
160.0	.03031	.01503	2724.0	4055.0	124.2	24.62	32.94	939.7	1.00009
170.0	.02852	.01415	2971.0	4384.0	126.2	24.67	32.99	968.4	1.00009
180.0	.02694	.01336	3217.0	4714.0	128.0	24.57	32.88	997.0	1.00008
190.0	.02552	.01266	3462.0	5042.0	129.8	24.35	32.67	1025.0	1.00008
200.0	.02424	.01203	3704.0	5367.0	131.5	24.08	32.39	1054.0	1.00007
210.0	.02309	.01145	3943.0	5690.0	133.1	23.77	32.08	1081.0	1.00007
220.0	.02204	.01093	4179.0	6009.0	134.5	23.45	31.76	1109.0	1.00007

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
230.0	.02108	.01046	4412.0	6325.0	135.9	23.13	31.45	1136.0	1.00006
240.0	.02020	.01002	4642.0	6638.0	137.3	22.84	31.15	1162.0	1.00006
250.0	.01940	.009622	4869.0	6948.0	138.5	22.57	30.88	1188.0	1.00006
260.0	.01865	.009252	5094.0	7256.0	139.8	22.32	30.64	1213.0	1.00006
270.0	.01796	.008909	5316.0	7561.0	140.9	22.10	30.42	1238.0	1.00006
280.0	.01732	.008591	5536.0	7864.0	142.0	21.91	30.23	1262.0	1.00005
300.0	.01616	.008018	5971.0	8465.0	144.1	21.61	29.93	1309.0	1.00005
320.0	.01515	.007517	6401.0	9062.0	146.0	21.39	29.71	1354.0	1.00005
340.0	.01426	.007075	6827.0	9654.0	147.8	21.24	29.56	1397.0	1.00004
360.0	.01347	.006682	7251.0	10240.0	149.5	21.14	29.45	1438.0	1.00004
380.0	.01276	.006331	7673.0	10830.0	151.1	21.07	29.38	1479.0	1.00004
400.0	.01212	.006014	8093.0	11420.0	152.6	21.02	29.33	1518.0	1.00004

.04 MPa isobar

13.81 ^a	77.05	38.22	-622.5	-621.4	10.01	10.96	15.53	1374.0	1.25168
14.0	76.89	38.14	-619.6	-618.6	10.21	10.60	15.16	1366.0	1.25112
15.0	76.03	37.71	-605.0	-603.9	11.22	9.66	14.37	1319.0	1.24809
16.0	75.13	37.27	-590.5	-589.5	12.16	9.66	14.70	1272.0	1.24495
17.505 ^b	73.71	36.56	-567.5	-566.4	13.54	10.23	16.09	1205.0	1.23996
17.505 ^b	.5841	.2897	207.4	345.5	65.63	13.04	22.86	336.7	1.00176
20.0	.5033	.2497	241.1	401.3	68.61	12.76	22.05	363.5	1.00152
21.0	.4772	.2367	254.3	423.2	69.68	12.69	21.85	373.5	1.00144
22.0	.4538	.2251	267.3	445.0	70.69	12.65	21.70	383.1	1.00137
23.0	.4328	.2147	280.3	466.7	71.66	12.61	21.58	392.4	1.00131
24.0	.4136	.2052	293.2	488.2	72.57	12.58	21.48	401.5	1.00125
26.0	.3802	.1886	318.9	531.0	74.29	12.55	21.33	418.9	1.00115
28.0	.3519	.1745	344.4	573.6	75.86	12.52	21.23	435.5	1.00106
30.0	.3276	.1625	369.8	615.9	77.33	12.51	21.16	451.5	1.00099
32.0	.3065	.1520	395.1	658.2	78.69	12.50	21.10	466.8	1.00092
34.0	.2880	.1429	420.4	700.4	79.97	12.49	21.06	481.6	1.00087
36.0	.2716	.1347	445.6	742.4	81.17	12.49	21.02	495.9	1.00082
38.0	.2571	.1275	470.8	784.5	82.31	12.48	21.00	509.7	1.00078
40.0	.2440	.1210	495.9	826.4	83.38	12.49	20.98	523.2	1.00074
42.0	.2322	.1152	521.1	868.4	84.41	12.51	20.99	536.1	1.00070
44.0	.2215	.1099	546.3	910.4	85.38	12.54	21.00	548.6	1.00067
46.0	.2117	.1050	571.5	952.4	86.32	12.57	21.01	560.9	1.00064
48.0	.2028	.1006	596.8	994.4	87.21	12.60	21.03	572.7	1.00061
50.0	.1946	.09654	622.2	1037.0	88.07	12.64	21.07	584.2	1.00059
52.0	.1871	.09279	647.6	1079.0	88.90	12.70	21.11	595.4	1.00056
54.0	.1801	.08933	673.2	1121.0	89.69	12.77	21.17	606.2	1.00054
56.0	.1736	.08611	698.9	1163.0	90.47	12.85	21.25	616.6	1.00052
58.0	.1676	.08312	724.8	1206.0	91.21	12.96	21.35	626.5	1.00051
60.0	.1619	.08033	750.9	1249.0	91.94	13.08	21.47	636.1	1.00049
65.0	.1494	.07412	817.4	1357.0	93.67	13.47	21.85	658.5	1.00045
70.0	.1387	.06880	886.1	1467.0	95.31	13.98	22.35	678.6	1.00042
75.0	.1294	.06420	957.6	1581.0	96.87	14.60	22.96	696.9	1.00039
80.0	.1213	.06017	1033.0	1697.0	98.37	15.32	23.67	713.6	1.00037
85.0	.1141	.05662	1111.0	1818.0	99.83	16.11	24.46	729.3	1.00034
90.0	.1078	.05347	1194.0	1942.0	101.3	16.95	25.29	744.1	1.00033
95.0	.1021	.05065	1281.0	2071.0	102.6	17.81	26.15	758.4	1.00031
100.0	.09700	.04811	1372.0	2203.0	104.0	18.69	27.02	772.3	1.00029
105.0	.09237	.04582	1468.0	2341.0	105.3	19.54	27.88	786.0	1.00028
110.0	.08817	.04374	1568.0	2482.0	106.7	20.37	28.70	799.6	1.00027
115.0	.08433	.04183	1671.0	2628.0	108.0	21.13	29.47	813.3	1.00026
120.0	.08081	.04009	1779.0	2777.0	109.2	21.83	30.16	827.0	1.00024
125.0	.07758	.03848	1890.0	2929.0	110.5	22.45	30.78	840.8	1.00023
130.0	.07459	.03700	2003.0	3084.0	111.7	22.98	31.31	854.8	1.00023
140.0	.06926	.03436	2238.0	3402.0	114.0	23.83	32.15	882.9	1.00021
150.0	.06464	.03207	2479.0	3726.0	116.3	24.35	32.68	911.3	1.00020
160.0	.06060	.03006	2724.0	4055.0	118.4	24.62	32.94	939.9	1.00018
170.0	.05704	.02829	2971.0	4384.0	120.4	24.67	32.99	968.6	1.00017
180.0	.05387	.02672	3217.0	4714.0	122.3	24.57	32.89	997.2	1.00016

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
190.0	.05103	.02531	3462.0	5042.0	124.1	24.35	32.67	1026.0	1.00015
200.0	.04848	.02405	3704.0	5367.0	125.7	24.08	32.40	1054.0	1.00015
210.0	.04617	.02290	3943.0	5690.0	127.3	23.77	32.08	1082.0	1.00014
220.0	.04407	.02186	4179.0	6009.0	128.8	23.45	31.77	1109.0	1.00013
230.0	.04216	.02091	4412.0	6325.0	130.2	23.13	31.45	1136.0	1.00013
240.0	.04040	.02004	4642.0	6638.0	131.5	22.84	31.16	1162.0	1.00012
250.0	.03879	.01924	4869.0	6948.0	132.8	22.57	30.88	1188.0	1.00012
260.0	.03729	.01850	5093.0	7256.0	134.0	22.32	30.64	1214.0	1.00011
270.0	.03591	.01781	5315.0	7561.0	135.1	22.10	30.42	1238.0	1.00011
280.0	.03463	.01718	5536.0	7864.0	136.2	21.91	30.23	1262.0	1.00011
300.0	.03232	.01603	5971.0	8466.0	138.3	21.61	29.93	1309.0	1.00010
320.0	.03030	.01503	6401.0	9062.0	140.2	21.39	29.71	1354.0	1.00009
340.0	.02852	.01415	6827.0	9654.0	142.0	21.24	29.56	1397.0	1.00009
360.0	.02694	.01336	7251.0	10240.0	143.7	21.14	29.45	1439.0	1.00008
380.0	.02552	.01266	7673.0	10830.0	145.3	21.07	29.38	1479.0	1.00008
400.0	.02424	.01203	8093.0	11420.0	146.8	21.02	29.33	1518.0	1.00007

.06 MPa isobar

13.82 ^a	77.06	38.23	-622.4	-620.9	10.01	10.96	15.51	1373.0	1.25172
14.0	76.91	38.15	-619.7	-618.1	10.21	10.61	15.16	1365.0	1.25118
15.0	76.04	37.72	-605.1	-603.5	11.22	9.67	14.36	1319.0	1.24815
16.0	75.15	37.28	-590.6	-589.0	12.15	9.66	14.70	1272.0	1.24502
18.0	73.23	36.33	-559.5	-557.9	13.98	10.46	16.63	1186.0	1.23831
18.629 ^b	72.58	36.00	-548.8	-547.2	14.57	10.75	17.39	1161.0	1.23602
18.629 ^b	.8376	.4155	217.2	361.6	63.35	13.14	23.49	344.4	1.00253
20.0	.7705	.3822	236.3	393.3	64.99	12.93	22.83	359.6	1.00232
21.0	.7286	.3614	249.9	415.9	66.10	12.83	22.49	370.0	1.00220
22.0	.6914	.3430	263.3	438.3	67.14	12.75	22.24	380.1	1.00209
23.0	.6581	.3264	276.6	460.4	68.12	12.69	22.04	389.7	1.00199
24.0	.6281	.3115	289.8	482.4	69.05	12.65	21.87	399.1	1.00189
25.0	.6008	.2980	302.8	504.2	69.94	12.61	21.74	408.2	1.00181
26.0	.5759	.2857	315.8	525.9	70.80	12.59	21.64	417.0	1.00174
28.0	.5321	.2640	341.6	569.0	72.39	12.55	21.47	433.9	1.00161
30.0	.4947	.2454	367.3	611.8	73.87	12.53	21.36	450.1	1.00149
32.0	.4624	.2294	392.8	654.4	75.25	12.51	21.27	465.7	1.00139
34.0	.4341	.2153	418.2	696.9	76.53	12.50	21.20	480.6	1.00131
36.0	.4092	.2030	443.6	739.2	77.74	12.50	21.15	495.1	1.00123
38.0	.3870	.1920	468.9	781.5	78.88	12.49	21.10	509.1	1.00117
40.0	.3671	.1821	494.2	823.6	79.97	12.50	21.08	522.6	1.00111
42.0	.3492	.1732	519.4	865.8	80.99	12.52	21.07	535.6	1.00105
44.0	.3330	.1652	544.7	907.9	81.97	12.54	21.07	548.2	1.00100
46.0	.3183	.1579	570.0	950.1	82.91	12.57	21.08	560.5	1.00096
48.0	.3048	.1512	595.4	992.2	83.81	12.60	21.10	572.5	1.00092
50.0	.2924	.1450	620.8	1034.0	84.67	12.65	21.13	584.0	1.00088
52.0	.2810	.1394	646.3	1077.0	85.50	12.70	21.17	595.2	1.00085
54.0	.2705	.1342	671.9	1119.0	86.30	12.77	21.22	606.0	1.00082
56.0	.2607	.1293	697.7	1162.0	87.07	12.86	21.30	616.4	1.00079
58.0	.2516	.1248	723.6	1204.0	87.82	12.96	21.39	626.5	1.00076
60.0	.2431	.1206	749.8	1247.0	88.55	13.08	21.51	636.1	1.00073
62.0	.2352	.1167	776.2	1290.0	89.26	13.22	21.64	645.3	1.00071
65.0	.2243	.1113	816.4	1356.0	90.28	13.47	21.88	658.5	1.00068
70.0	.2082	.1033	885.2	1466.0	91.92	13.98	22.38	678.6	1.00063
75.0	.1942	.09633	956.8	1580.0	93.49	14.61	22.99	696.9	1.00059
80.0	.1820	.09028	1032.0	1696.0	94.99	15.32	23.70	713.7	1.00055
85.0	.1713	.08495	1110.0	1817.0	96.45	16.11	24.48	729.4	1.00052
90.0	.1617	.08022	1193.0	1941.0	97.88	16.95	25.31	744.2	1.00049
95.0	.1532	.07598	1280.0	2070.0	99.27	17.81	26.17	758.5	1.00046
100.0	.1455	.07217	1372.0	2203.0	100.6	18.69	27.04	772.4	1.00044
105.0	.1386	.06873	1467.0	2340.0	102.0	19.54	27.89	786.1	1.00042
110.0	.1322	.06560	1567.0	2482.0	103.3	20.37	28.71	799.8	1.00040
115.0	.1265	.06274	1671.0	2627.0	104.6	21.14	29.48	813.4	1.00038

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
120.0	.1212	.06013	1778.0	2776.0	105.9	21.83	30.17	827.2	1.00037
125.0	.1164	.05772	1889.0	2929.0	107.1	22.45	30.79	841.0	1.00035
130.0	.1119	.05550	2003.0	3084.0	108.3	22.98	31.32	855.0	1.00034
140.0	.1039	.05153	2237.0	3402.0	110.7	23.83	32.16	883.1	1.00031
150.0	.09695	.04809	2478.0	3726.0	112.9	24.35	32.68	911.5	1.00029
160.0	.09089	.04509	2724.0	4054.0	115.0	24.62	32.95	940.1	1.00027
170.0	.08554	.04243	2970.0	4384.0	117.0	24.67	33.00	968.8	1.00026
180.0	.08079	.04008	3217.0	4714.0	118.9	24.57	32.89	997.4	1.00024
190.0	.07654	.03797	3461.0	5042.0	120.7	24.35	32.68	1026.0	1.00023
200.0	.07271	.03607	3704.0	5367.0	122.3	24.08	32.40	1054.0	1.00022
210.0	.06925	.03435	3943.0	5690.0	123.9	23.77	32.09	1082.0	1.00021
220.0	.06610	.03279	4179.0	6009.0	125.4	23.45	31.77	1109.0	1.00020
230.0	.06323	.03136	4412.0	6325.0	126.8	23.14	31.45	1136.0	1.00019
240.0	.06059	.03006	4642.0	6638.0	128.1	22.84	31.16	1163.0	1.00018
250.0	.05817	.02886	4869.0	6948.0	129.4	22.57	30.89	1188.0	1.00018
260.0	.05593	.02775	5093.0	7256.0	130.6	22.32	30.64	1214.0	1.00017
270.0	.05386	.02672	5315.0	7561.0	131.8	22.10	30.42	1238.0	1.00016
280.0	.05194	.02576	5535.0	7864.0	132.9	21.91	30.23	1263.0	1.00016
300.0	.04848	.02405	5971.0	8466.0	134.9	21.61	29.93	1309.0	1.00015
320.0	.04545	.02254	6401.0	9062.0	136.9	21.39	29.71	1354.0	1.00014
340.0	.04277	.02122	6827.0	9655.0	138.7	21.24	29.56	1397.0	1.00013
360.0	.04040	.02004	7251.0	10240.0	140.4	21.14	29.45	1439.0	1.00012
380.0	.03827	.01899	7673.0	10830.0	141.9	21.07	29.38	1479.0	1.00012
400.0	.03636	.01804	8093.0	11420.0	143.5	21.02	29.33	1518.0	1.00011

.08 MPa isobar

13.83 ^a	77.07	38.23	-622.4	-620.3	10.01	10.96	15.49	1373.0	1.25175
14.0	76.92	38.16	-619.8	-617.7	10.20	10.63	15.16	1365.0	1.25123
15.0	76.06	37.73	-605.2	-603.1	11.21	9.68	14.36	1319.0	1.24821
16.0	75.17	37.29	-590.8	-588.6	12.15	9.67	14.69	1272.0	1.24509
18.0	73.26	36.34	-559.7	-557.5	13.98	10.47	16.62	1187.0	1.23838
19.504 ^b	71.65	35.54	-533.3	-531.1	15.38	11.13	18.48	1129.0	1.23280
19.504 ^b	1.083	.5373	224.0	372.9	61.73	13.23	24.07	349.8	1.00327
20.0	1.050	.5209	231.2	384.8	62.33	13.13	23.75	355.5	1.00317
21.0	.9898	.4910	245.3	408.2	63.48	12.98	23.23	366.5	1.00299
22.0	.9370	.4648	259.1	431.3	64.55	12.87	22.84	376.9	1.00283
23.0	.8901	.4415	272.8	453.9	65.56	12.78	22.54	387.0	1.00269
24.0	.8481	.4207	286.2	476.4	66.51	12.72	22.30	396.6	1.00256
25.0	.8102	.4019	299.5	498.6	67.42	12.67	22.12	405.9	1.00244
26.0	.7757	.3848	312.7	520.6	68.28	12.63	21.96	415.0	1.00234
28.0	.7154	.3549	338.8	564.3	69.90	12.58	21.73	432.3	1.00216
30.0	.6642	.3295	364.7	607.6	71.39	12.55	21.56	448.8	1.00200
32.0	.6201	.3076	390.5	650.6	72.78	12.53	21.44	464.5	1.00187
34.0	.5817	.2885	416.1	693.3	74.08	12.51	21.35	479.7	1.00175
36.0	.5479	.2718	441.6	736.0	75.29	12.50	21.27	494.3	1.00165
38.0	.5179	.2569	467.0	778.4	76.44	12.50	21.21	508.4	1.00156
40.0	.4910	.2436	492.4	820.8	77.53	12.50	21.17	522.0	1.00148
42.0	.4669	.2316	517.7	863.2	78.56	12.52	21.16	535.1	1.00141
44.0	.4451	.2208	543.1	905.5	79.55	12.54	21.15	547.8	1.00134
46.0	.4253	.2110	568.5	947.8	80.49	12.57	21.15	560.2	1.00128
48.0	.4071	.2020	594.0	990.1	81.39	12.61	21.16	572.2	1.00123
50.0	.3905	.1937	619.4	1032.0	82.25	12.65	21.18	583.8	1.00118
52.0	.3752	.1861	645.0	1075.0	83.08	12.70	21.22	595.0	1.00113
54.0	.3611	.1791	670.7	1117.0	83.88	12.77	21.27	605.9	1.00109
56.0	.3480	.1726	696.5	1160.0	84.66	12.86	21.35	616.3	1.00105
58.0	.3358	.1666	722.5	1203.0	85.41	12.96	21.44	626.4	1.00101
60.0	.3245	.1610	748.7	1246.0	86.14	13.08	21.55	636.0	1.00098
62.0	.3139	.1557	775.1	1289.0	86.85	13.22	21.68	645.3	1.00095
65.0	.2993	.1484	815.3	1354.0	87.88	13.47	21.91	658.5	1.00090
70.0	.2777	.1377	884.2	1465.0	89.52	13.99	22.41	678.7	1.00084
75.0	.2590	.1285	955.9	1579.0	91.08	14.61	23.01	697.0	1.00078
80.0	.2427	.1204	1031.0	1695.0	92.59	15.32	23.72	713.8	1.00073

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
85.0	.2284	.1133	1110.0	1816.0	94.05	16.11	24.50	729.5	1.00069
90.0	.2156	.1070	1192.0	1940.0	95.48	16.95	25.32	744.3	1.00065
95.0	.2042	.1013	1280.0	2069.0	96.87	17.82	26.18	758.6	1.00062
100.0	.1940	.09624	1371.0	2202.0	98.23	18.69	27.05	772.5	1.00059
105.0	.1847	.09164	1467.0	2340.0	99.57	19.55	27.90	786.3	1.00056
110.0	.1763	.08747	1567.0	2481.0	100.9	20.37	28.72	799.9	1.00053
115.0	.1686	.08365	1670.0	2627.0	102.2	21.14	29.49	813.6	1.00051
120.0	.1616	.08016	1778.0	2776.0	103.5	21.84	30.18	827.3	1.00049
125.0	.1551	.07695	1889.0	2928.0	104.7	22.45	30.80	841.2	1.00047
130.0	.1492	.07399	2003.0	3084.0	105.9	22.99	31.33	855.1	1.00045
140.0	.1385	.06870	2237.0	3401.0	108.3	23.83	32.16	883.2	1.00042
150.0	.1293	.06412	2478.0	3726.0	110.5	24.35	32.69	911.7	1.00039
160.0	.1212	.06011	2723.0	4054.0	112.6	24.62	32.95	940.3	1.00037
170.0	.1140	.05657	2970.0	4384.0	114.6	24.67	33.00	968.9	1.00034
180.0	.1077	.05343	3216.0	4714.0	116.5	24.57	32.89	997.5	1.00033
190.0	.1020	.05061	3461.0	5042.0	118.3	24.36	32.68	1026.0	1.00031
200.0	.09693	.04808	3703.0	5367.0	120.0	24.08	32.40	1054.0	1.00029
210.0	.09232	.04579	3943.0	5690.0	121.5	23.77	32.09	1082.0	1.00028
220.0	.08812	.04371	4179.0	6009.0	123.0	23.45	31.77	1109.0	1.00027
230.0	.08429	.04181	4412.0	6325.0	124.4	23.14	31.46	1136.0	1.00025
240.0	.08078	.04007	4642.0	6638.0	125.8	22.84	31.16	1163.0	1.00024
250.0	.07755	.03847	4869.0	6948.0	127.0	22.57	30.89	1189.0	1.00023
260.0	.07457	.03699	5093.0	7256.0	128.2	22.32	30.64	1214.0	1.00023
270.0	.07181	.03562	5315.0	7561.0	129.4	22.11	30.42	1239.0	1.00022
280.0	.06924	.03435	5535.0	7865.0	130.5	21.92	30.23	1263.0	1.00021
300.0	.06463	.03206	5970.0	8466.0	132.6	21.61	29.93	1310.0	1.00020
320.0	.06059	.03006	6400.0	9062.0	134.5	21.39	29.71	1354.0	1.00018
340.0	.05703	.02829	6827.0	9655.0	136.3	21.24	29.56	1397.0	1.00017
360.0	.05386	.02672	7250.0	10240.0	138.0	21.14	29.45	1439.0	1.00016
380.0	.05103	.02531	7673.0	10830.0	139.6	21.07	29.38	1479.0	1.00015
400.0	.04848	.02405	8093.0	11420.0	141.1	21.02	29.33	1518.0	1.00015

.10 MPa isobar

13.83 ^a	77.08	38.23	-622.4	-619.8	10.02	10.96	15.47	1372.0	1.25178
14.0	76.94	38.16	-619.9	-617.2	10.20	10.64	15.15	1365.0	1.25129
15.0	76.08	37.74	-605.3	-602.6	11.21	9.69	14.35	1319.0	1.24827
16.0	75.19	37.30	-590.9	-588.2	12.14	9.68	14.68	1272.0	1.24515
18.0	73.28	36.35	-559.8	-557.0	13.97	10.47	16.61	1187.0	1.23846
20.0	71.12	35.28	-524.2	-521.4	15.85	11.32	19.11	1111.0	1.23093
20.232 ^b	70.85	35.14	-519.7	-516.9	16.07	11.41	19.43	1102.0	1.22999
20.232 ^b	1.324	.6566	229.2	381.5	60.47	13.31	24.64	353.8	1.00399
25.0	1.025	.5082	296.1	492.8	65.42	12.73	22.52	403.7	1.00309
26.0	.9798	.4860	309.5	515.2	66.30	12.68	22.31	412.9	1.00296
28.0	.9018	.4473	336.0	559.5	67.94	12.61	22.00	430.6	1.00272
30.0	.8360	.4147	362.2	603.3	69.45	12.57	21.78	447.4	1.00252
32.0	.7797	.3867	388.1	646.7	70.85	12.54	21.62	463.4	1.00235
34.0	.7307	.3625	413.9	689.8	72.16	12.52	21.50	478.7	1.00220
36.0	.6877	.3411	439.6	732.7	73.38	12.51	21.40	493.5	1.00207
38.0	.6497	.3223	465.1	775.4	74.54	12.50	21.33	507.7	1.00196
40.0	.6158	.3054	490.6	818.0	75.63	12.51	21.27	521.5	1.00186
42.0	.5853	.2903	516.1	860.5	76.67	12.53	21.25	534.7	1.00177
44.0	.5577	.2767	541.5	903.0	77.66	12.55	21.23	547.4	1.00168
46.0	.5327	.2643	567.0	945.4	78.60	12.58	21.22	559.9	1.00161
48.0	.5099	.2529	592.5	987.9	79.50	12.61	21.23	571.9	1.00154
50.0	.4890	.2425	618.1	1030.0	80.37	12.65	21.24	583.6	1.00147
52.0	.4697	.2330	643.7	1073.0	81.20	12.71	21.28	594.9	1.00142
54.0	.4520	.2242	669.4	1115.0	82.01	12.78	21.32	605.7	1.00136
56.0	.4355	.2160	695.3	1158.0	82.78	12.86	21.39	616.2	1.00131
58.0	.4202	.2084	721.3	1201.0	83.54	12.96	21.48	626.3	1.00127
60.0	.4060	.2014	747.5	1244.0	84.27	13.09	21.59	636.0	1.00122
62.0	.3927	.1948	774.0	1287.0	84.97	13.23	21.72	645.3	1.00118
65.0	.3743	.1857	814.3	1353.0	86.01	13.48	21.95	658.5	1.00113

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
70.0	.3473	.1723	883.3	1464.0	87.65	13.99	22.44	678.7	1.00105
75.0	.3239	.1607	955.1	1577.0	89.22	14.61	23.04	697.1	1.00098
80.0	.3035	.1506	1030.0	1694.0	90.73	15.33	23.74	713.9	1.00092
85.0	.2855	.1416	1109.0	1815.0	92.19	16.11	24.51	729.6	1.00086
90.0	.2696	.1337	1192.0	1940.0	93.61	16.95	25.34	744.4	1.00081
95.0	.2553	.1267	1279.0	2068.0	95.01	17.82	26.20	758.7	1.00077
100.0	.2425	.1203	1370.0	2202.0	96.37	18.69	27.06	772.7	1.00073
105.0	.2309	.1146	1466.0	2339.0	97.71	19.55	27.92	786.4	1.00070
110.0	.2204	.1093	1566.0	2481.0	99.03	20.37	28.73	800.1	1.00067
115.0	.2108	.1046	1670.0	2626.0	100.3	21.14	29.50	813.7	1.00064
120.0	.2020	.1002	1777.0	2776.0	101.6	21.84	30.19	827.5	1.00061
125.0	.1939	.09618	1888.0	2928.0	102.8	22.46	30.81	841.3	1.00059
130.0	.1864	.09248	2002.0	3083.0	104.1	22.99	31.33	855.3	1.00056
140.0	.1731	.08586	2237.0	3401.0	106.4	23.83	32.17	883.4	1.00052
150.0	.1615	.08013	2478.0	3726.0	108.7	24.35	32.69	911.9	1.00049
160.0	.1514	.07512	2723.0	4054.0	110.8	24.62	32.96	940.4	1.00046
170.0	.1425	.07070	2970.0	4384.0	112.8	24.67	33.01	969.1	1.00043
180.0	.1346	.06677	3216.0	4714.0	114.7	24.57	32.90	997.7	1.00041
190.0	.1275	.06326	3461.0	5042.0	116.4	24.36	32.68	1026.0	1.00039
200.0	.1211	.06010	3703.0	5367.0	118.1	24.08	32.40	1054.0	1.00037
210.0	.1154	.05723	3942.0	5690.0	119.7	23.77	32.09	1082.0	1.00035
220.0	.1101	.05463	4179.0	6009.0	121.2	23.45	31.77	1110.0	1.00033
230.0	.1053	.05226	4412.0	6325.0	122.6	23.14	31.46	1136.0	1.00032
240.0	.1010	.05008	4641.0	6638.0	123.9	22.84	31.16	1163.0	1.00031
250.0	.09692	.04808	4868.0	6948.0	125.2	22.57	30.89	1189.0	1.00029
260.0	.09320	.04623	5093.0	7256.0	126.4	22.32	30.64	1214.0	1.00028
270.0	.08975	.04452	5315.0	7561.0	127.5	22.11	30.42	1239.0	1.00027
280.0	.08654	.04293	5535.0	7865.0	128.6	21.92	30.23	1263.0	1.00026
300.0	.08077	.04007	5970.0	8466.0	130.7	21.61	29.93	1310.0	1.00024
320.0	.07573	.03756	6400.0	9062.0	132.6	21.39	29.71	1355.0	1.00023
340.0	.07127	.03536	6827.0	9655.0	134.4	21.24	29.56	1398.0	1.00022
360.0	.06732	.03339	7250.0	10250.0	136.1	21.14	29.46	1439.0	1.00020
380.0	.06378	.03164	7672.0	10830.0	137.7	21.07	29.38	1479.0	1.00019
400.0	.06059	.03005	8093.0	11420.0	139.2	21.02	29.33	1518.0	1.00018

.101325 MPa isobar

13.83 ^a	77.08	38.23	-622.4	-619.7	10.02	10.96	15.47	1372.0	1.25178
14.0	76.94	38.16	-619.9	-617.2	10.20	10.64	15.15	1365.0	1.25129
15.0	76.08	37.74	-605.3	-602.6	11.21	9.69	14.35	1319.0	1.24827
16.0	75.19	37.30	-590.9	-588.1	12.14	9.68	14.68	1272.0	1.24516
18.0	73.28	36.35	-559.8	-557.0	13.97	10.47	16.61	1187.0	1.23847
20.0	71.12	35.28	-524.2	-521.4	15.85	11.33	19.11	1111.0	1.23094
20.277 ^b	70.80	35.12	-518.9	-516.0	16.11	11.43	19.49	1101.0	1.22982
20.277 ^b	1.339	.6644	229.5	382.0	60.40	13.31	24.68	354.1	1.00404
25.0	1.039	.5154	295.8	492.4	65.30	12.74	22.54	403.5	1.00313
26.0	.9935	.4928	309.3	514.9	66.18	12.69	22.33	412.8	1.00300
28.0	.9143	.4535	335.8	559.2	67.82	12.62	22.02	430.5	1.00276
30.0	.8475	.4204	362.0	603.0	69.33	12.57	21.79	447.3	1.00256
32.0	.7903	.3920	388.0	646.4	70.74	12.54	21.63	463.3	1.00238
34.0	.7406	.3674	413.8	689.6	72.04	12.53	21.51	478.7	1.00223
36.0	.6970	.3458	439.4	732.5	73.27	12.51	21.41	493.4	1.00210
38.0	.6585	.3266	465.0	775.2	74.43	12.50	21.33	507.7	1.00199
40.0	.6240	.3096	490.5	817.8	75.52	12.51	21.28	521.4	1.00188
42.0	.5931	.2942	516.0	860.3	76.56	12.53	21.25	534.6	1.00179
44.0	.5652	.2804	541.4	902.8	77.54	12.55	21.23	547.4	1.00170
46.0	.5398	.2678	566.9	945.3	78.49	12.58	21.23	559.8	1.00163
48.0	.5167	.2563	592.4	987.7	79.39	12.61	21.23	571.9	1.00156
50.0	.4955	.2458	618.0	1030.0	80.26	12.65	21.25	583.6	1.00149
52.0	.4760	.2361	643.6	1073.0	81.09	12.71	21.28	594.8	1.00144
54.0	.4580	.2272	669.3	1115.0	81.90	12.78	21.33	605.7	1.00138
56.0	.4413	.2189	695.2	1158.0	82.67	12.86	21.39	616.2	1.00133

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
58.0	.4258	.2112	721.2	1201.0	83.42	12.96	21.48	626.3	1.00128
60.0	.4114	.2041	747.5	1244.0	84.15	13.09	21.59	636.0	1.00124
62.0	.3979	.1974	774.0	1287.0	84.86	13.23	21.72	645.3	1.00120
65.0	.3793	.1882	814.3	1353.0	85.90	13.48	21.95	658.5	1.00114
70.0	.3519	.1746	883.2	1464.0	87.54	13.99	22.44	678.7	1.00106
75.0	.3282	.1628	955.0	1577.0	89.11	14.61	23.04	697.1	1.00099
80.0	.3075	.1526	1030.0	1694.0	90.62	15.33	23.74	713.9	1.00093
85.0	.2893	.1435	1109.0	1815.0	92.08	16.11	24.52	729.6	1.00087
90.0	.2732	.1355	1192.0	1940.0	93.50	16.95	25.34	744.4	1.00082
95.0	.2587	.1283	1279.0	2068.0	94.90	17.82	26.20	758.7	1.00078
100.0	.2457	.1219	1370.0	2202.0	96.26	18.69	27.07	772.7	1.00074
105.0	.2340	.1161	1466.0	2339.0	97.60	19.55	27.92	786.4	1.00071
110.0	.2233	.1108	1566.0	2481.0	98.92	20.37	28.73	800.1	1.00067
115.0	.2136	.1059	1670.0	2626.0	100.2	21.14	29.50	813.7	1.00064
120.0	.2047	.1015	1777.0	2776.0	101.5	21.84	30.19	827.5	1.00062
125.0	.1965	.09746	1888.0	2928.0	102.7	22.46	30.81	841.3	1.00059
130.0	.1889	.09370	2002.0	3083.0	103.9	22.99	31.33	855.3	1.00057
140.0	.1754	.08700	2236.0	3401.0	106.3	23.83	32.17	883.4	1.00053
150.0	.1637	.08119	2478.0	3726.0	108.5	24.35	32.69	911.9	1.00049
160.0	.1534	.07612	2723.0	4054.0	110.7	24.62	32.96	940.5	1.00046
170.0	.1444	.07164	2970.0	4384.0	112.7	24.67	33.01	969.1	1.00044
180.0	.1364	.06766	3216.0	4714.0	114.5	24.57	32.90	997.7	1.00041
190.0	.1292	.06410	3461.0	5042.0	116.3	24.36	32.68	1026.0	1.00039
200.0	.1228	.06089	3703.0	5367.0	118.0	24.08	32.40	1054.0	1.00037
210.0	.1169	.05799	3942.0	5690.0	119.6	23.77	32.09	1082.0	1.00035
220.0	.1116	.05536	4179.0	6009.0	121.0	23.45	31.77	1110.0	1.00034
230.0	.1067	.05295	4412.0	6325.0	122.5	23.14	31.46	1136.0	1.00032
240.0	.1023	.05074	4641.0	6638.0	123.8	22.84	31.16	1163.0	1.00031
250.0	.09821	.04871	4868.0	6948.0	125.1	22.57	30.89	1189.0	1.00030
260.0	.09443	.04684	5093.0	7256.0	126.3	22.32	30.64	1214.0	1.00029
270.0	.09093	.04511	5315.0	7561.0	127.4	22.11	30.43	1239.0	1.00027
280.0	.08769	.04350	5535.0	7865.0	128.5	21.92	30.23	1263.0	1.00027
300.0	.08184	.04060	5970.0	8466.0	130.6	21.61	29.93	1310.0	1.00025
320.0	.07673	.03806	6400.0	9062.0	132.5	21.39	29.71	1355.0	1.00023
340.0	.07222	.03582	6827.0	9655.0	134.3	21.24	29.56	1398.0	1.00022
360.0	.06821	.03384	7250.0	10250.0	136.0	21.14	29.46	1439.0	1.00021
380.0	.06462	.03206	7672.0	10830.0	137.6	21.07	29.38	1479.0	1.00020
400.0	.06139	.03045	8093.0	11420.0	139.1	21.02	29.33	1518.0	1.00019

.20 MPa isobar

13.87 ^a	77.12	38.26	-622.3	-617.0	10.02	10.96	15.39	1368.0	1.25195
14.0	77.01	38.20	-620.3	-615.0	10.17	10.71	15.14	1362.0	1.25155
15.0	76.16	37.78	-605.7	-600.4	11.18	9.74	14.33	1318.0	1.24856
16.0	75.28	37.34	-591.4	-586.0	12.11	9.71	14.64	1273.0	1.24548
18.0	73.39	36.41	-560.5	-555.0	13.93	10.49	16.55	1190.0	1.23885
20.0	71.25	35.35	-525.1	-519.5	15.80	11.33	19.02	1116.0	1.23141
22.0	68.79	34.12	-484.5	-478.6	17.74	11.98	21.88	1041.0	1.22285
22.810 ^b	67.67	33.57	-466.4	-460.4	18.56	12.19	23.21	1008.0	1.21898
22.810 ^b	2.496	1.238	242.8	404.4	56.47	13.62	27.45	365.4	1.00754
25.0	2.187	1.085	277.3	461.6	58.87	13.13	25.15	391.3	1.00661
26.0	2.075	1.029	292.1	486.5	59.84	12.99	24.50	402.0	1.00627
27.0	1.976	.9802	306.7	510.7	60.75	12.89	24.00	412.2	1.00597
28.0	1.887	.9362	320.9	534.5	61.62	12.81	23.61	422.0	1.00570
29.0	1.808	.8966	334.9	557.9	62.44	12.75	23.28	431.3	1.00546
30.0	1.735	.8606	348.7	581.1	63.23	12.70	23.02	440.4	1.00524
32.0	1.608	.7975	375.9	626.7	64.70	12.63	22.61	457.6	1.00485
34.0	1.499	.7438	402.7	671.6	66.06	12.59	22.32	473.9	1.00453
36.0	1.406	.6973	429.2	716.0	67.33	12.56	22.10	489.5	1.00424
38.0	1.324	.6567	455.5	760.0	68.52	12.54	21.92	504.4	1.00400
40.0	1.252	.6208	481.6	803.7	69.64	12.54	21.79	518.7	1.00378
42.0	1.187	.5888	507.6	847.2	70.70	12.55	21.70	532.3	1.00358

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p	Sound m/s	Diel. const.
44.0	1.129	.5601	533.5	890.6	71.71	12.57	21.64	545.5	1.00341
46.0	1.077	.5342	559.4	933.8	72.67	12.59	21.59	558.2	1.00325
48.0	1.029	.5107	585.3	976.9	73.59	12.63	21.56	570.6	1.00311
50.0	.9861	.4892	611.2	1020.0	74.47	12.67	21.55	582.5	1.00298
52.0	.9464	.4695	637.1	1063.0	75.31	12.72	21.58	594.0	1.00286
54.0	.9098	.4513	663.1	1106.0	76.13	12.79	21.63	605.1	1.00274
56.0	.8761	.4346	689.2	1149.0	76.91	12.87	21.63	615.7	1.00264
58.0	.8448	.4191	715.5	1193.0	77.67	12.98	21.70	625.9	1.00255
60.0	.8157	.4046	742.0	1236.0	78.41	13.10	21.79	635.7	1.00246
62.0	.7886	.3912	768.7	1280.0	79.13	13.24	21.90	645.1	1.00238
65.0	.7512	.3726	809.2	1346.0	80.17	13.49	22.12	658.5	1.00227
70.0	.6964	.3454	878.6	1458.0	81.82	14.00	22.58	678.9	1.00210
75.0	.6491	.3220	950.8	1572.0	83.40	14.62	23.16	697.4	1.00196
80.0	.6079	.3015	1026.0	1689.0	84.91	15.33	23.85	714.3	1.00183
85.0	.5716	.2836	1105.0	1811.0	86.38	16.12	24.61	730.1	1.00172
90.0	.5395	.2676	1188.0	1936.0	87.81	16.96	25.43	745.0	1.00163
95.0	.5109	.2534	1276.0	2065.0	89.21	17.83	26.28	759.4	1.00154
100.0	.4851	.2406	1367.0	2198.0	90.58	18.70	27.13	773.3	1.00146
105.0	.4619	.2291	1463.0	2336.0	91.92	19.55	27.98	787.1	1.00139
110.0	.4407	.2186	1563.0	2478.0	93.24	20.38	28.79	800.8	1.00133
115.0	.4215	.2091	1667.0	2624.0	94.54	21.15	29.55	814.5	1.00127
120.0	.4038	.2003	1775.0	2773.0	95.81	21.84	30.24	828.3	1.00122
125.0	.3876	.1923	1886.0	2926.0	97.06	22.46	30.85	842.1	1.00117
130.0	.3727	.1849	2000.0	3082.0	98.28	22.99	31.37	856.1	1.00112
140.0	.3460	.1716	2235.0	3400.0	100.6	23.83	32.20	884.3	1.00104
150.0	.3229	.1602	2476.0	3725.0	102.9	24.36	32.72	912.7	1.00097
160.0	.3027	.1501	2721.0	4053.0	105.0	24.63	32.98	941.3	1.00091
170.0	.2849	.1413	2968.0	4384.0	107.0	24.68	33.03	970.0	1.00086
180.0	.2690	.1334	3215.0	4713.0	108.9	24.57	32.92	998.6	1.00081
190.0	.2549	.1264	3460.0	5042.0	110.7	24.36	32.70	1027.0	1.00077
200.0	.2421	.1201	3702.0	5367.0	112.3	24.08	32.42	1055.0	1.00073
210.0	.2306	.1144	3941.0	5690.0	113.9	23.77	32.11	1083.0	1.00070
220.0	.2201	.1092	4178.0	6009.0	115.4	23.45	31.78	1110.0	1.00066
230.0	.2105	.1044	4411.0	6326.0	116.8	23.14	31.47	1137.0	1.00064
240.0	.2018	.1001	4641.0	6639.0	118.1	22.84	31.17	1164.0	1.00061
250.0	.1937	.09609	4868.0	6949.0	119.4	22.57	30.90	1190.0	1.00058
260.0	.1863	.09240	5092.0	7257.0	120.6	22.33	30.65	1215.0	1.00056
270.0	.1794	.08898	5314.0	7562.0	121.8	22.11	30.43	1240.0	1.00054
280.0	.1730	.08580	5535.0	7866.0	122.9	21.92	30.24	1264.0	1.00052
300.0	.1614	.08009	5970.0	8467.0	124.9	21.61	29.94	1311.0	1.00049
320.0	.1514	.07509	6400.0	9064.0	126.9	21.40	29.72	1355.0	1.00046
340.0	.1425	.07067	6826.0	9656.0	128.7	21.24	29.56	1398.0	1.00043
360.0	.1346	.06675	7250.0	10250.0	130.3	21.14	29.46	1440.0	1.00041
380.0	.1275	.06324	7672.0	10830.0	131.9	21.07	29.39	1480.0	1.00039
400.0	.1211	.06008	8093.0	11420.0	133.4	21.02	29.33	1519.0	1.00037

.30 MPa isobar

13.90*	77.17	38.28	-622.1	-614.3	10.03	10.96	15.31	1364.0	1.25211
14.0	77.09	38.24	-620.7	-612.8	10.14	10.78	15.13	1360.0	1.25182
15.0	76.25	37.82	-606.2	-598.2	11.15	9.79	14.30	1317.0	1.24886
16.0	75.38	37.39	-591.9	-583.8	12.07	9.75	14.61	1274.0	1.24580
18.0	73.50	36.46	-561.1	-552.9	13.89	10.50	16.49	1194.0	1.23924
20.0	71.39	35.41	-526.0	-517.5	15.76	11.34	18.93	1121.0	1.23187
22.0	68.96	34.21	-485.7	-477.0	17.69	11.98	21.73	1048.0	1.22342
23.0	67.58	33.52	-463.4	-454.4	18.69	12.23	23.35	1008.0	1.21867
24.0	66.08	32.78	-439.3	-430.2	19.72	12.45	25.25	964.4	1.21347
24.576 ^b	65.14	32.31	-424.6	-415.3	20.33	12.57	26.52	937.4	1.21023
24.576 ^b	3.667	1.819	246.9	411.8	53.98	13.90	30.54	370.9	1.01109
25.0	3.559	1.765	254.6	424.6	54.50	13.74	29.60	376.7	1.01076
26.0	3.334	1.654	271.9	453.3	55.62	13.45	27.92	389.6	1.01008
27.0	3.145	1.560	288.3	480.6	56.65	13.24	26.72	401.4	1.00951
28.0	2.982	1.479	304.0	506.8	57.61	13.09	25.83	412.5	1.00901

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C, J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
29.0	2.838	1.408	319.2	532.3	58.50	12.97	25.15	422.9	1.00858
30.0	2.711	1.345	334.1	557.2	59.35	12.88	24.61	432.9	1.00819
31.0	2.596	1.288	348.6	581.6	60.15	12.80	24.18	442.4	1.00784
32.0	2.492	1.236	362.9	605.6	60.91	12.75	23.83	451.6	1.00753
34.0	2.311	1.146	391.0	652.6	62.34	12.67	23.28	469.0	1.00698
36.0	2.157	1.070	418.5	698.8	63.65	12.62	22.88	485.4	1.00652
38.0	2.025	1.004	445.5	744.2	64.88	12.58	22.58	501.0	1.00611
40.0	1.909	.9468	472.3	789.2	66.04	12.57	22.36	515.9	1.00576
42.0	1.806	.8960	498.9	833.7	67.12	12.58	22.20	530.0	1.00545
44.0	1.715	.8507	525.3	878.0	68.15	12.59	22.07	543.6	1.00518
46.0	1.633	.8101	551.7	922.0	69.13	12.61	21.97	556.7	1.00493
48.0	1.559	.7733	577.9	965.9	70.06	12.64	21.90	569.3	1.00471
50.0	1.492	.7399	604.2	1010.0	70.96	12.68	21.86	581.5	1.00450
52.0	1.430	.7094	630.5	1053.0	71.81	12.73	21.84	593.2	1.00432
54.0	1.374	.6814	656.8	1097.0	72.64	12.80	21.84	604.4	1.00415
56.0	1.322	.6557	683.1	1141.0	73.43	12.88	21.86	615.2	1.00399
58.0	1.274	.6318	709.7	1184.0	74.20	12.99	21.92	625.6	1.00384
60.0	1.229	.6097	736.4	1228.0	74.95	13.11	21.99	635.5	1.00371
62.0	1.188	.5892	763.3	1272.0	75.67	13.25	22.09	645.0	1.00358
64.0	1.149	.5700	790.4	1317.0	76.37	13.41	22.22	654.1	1.00347
70.0	1.047	.5195	874.0	1451.0	78.38	14.01	22.73	679.1	1.00316
75.0	.9754	.4839	946.5	1566.0	79.97	14.63	23.29	697.8	1.00294
80.0	.9131	.4529	1022.0	1685.0	81.49	15.34	23.96	714.8	1.00275
85.0	.8583	.4258	1102.0	1806.0	82.97	16.13	24.71	730.6	1.00259
90.0	.8098	.4017	1185.0	1932.0	84.40	16.97	25.51	745.6	1.00244
95.0	.7666	.3803	1272.0	2061.0	85.80	17.83	26.35	760.0	1.00231
100.0	.7278	.3610	1364.0	2195.0	87.18	18.71	27.20	774.0	1.00220
105.0	.6928	.3437	1460.0	2333.0	88.53	19.56	28.04	787.8	1.00209
110.0	.6610	.3279	1561.0	2476.0	89.85	20.38	28.84	801.5	1.00199
115.0	.6321	.3135	1665.0	2622.0	91.15	21.15	29.60	815.3	1.00191
120.0	.6056	.3004	1773.0	2771.0	92.42	21.85	30.28	829.0	1.00183
125.0	.5812	.2883	1884.0	2924.0	93.67	22.47	30.89	842.9	1.00175
130.0	.5587	.2772	1998.0	3080.0	94.89	23.00	31.41	857.0	1.00169
140.0	.5187	.2573	2233.0	3399.0	97.25	23.84	32.24	885.1	1.00156
150.0	.4840	.2401	2474.0	3724.0	99.50	24.37	32.75	913.6	1.00146
160.0	.4537	.2251	2720.0	4053.0	101.6	24.63	33.00	942.2	1.00137
170.0	.4270	.2118	2967.0	4383.0	103.6	24.68	33.05	970.9	1.00129
180.0	.4033	.2000	3213.0	4713.0	105.5	24.58	32.94	999.5	1.00122
190.0	.3820	.1895	3458.0	5042.0	107.3	24.36	32.72	1028.0	1.00115
200.0	.3629	.1800	3701.0	5367.0	109.0	24.09	32.43	1056.0	1.00109
210.0	.3456	.1715	3940.0	5690.0	110.5	23.78	32.12	1084.0	1.00104
220.0	.3299	.1637	4177.0	6010.0	112.0	23.46	31.80	1111.0	1.00100
230.0	.3156	.1566	4410.0	6326.0	113.4	23.14	31.48	1138.0	1.00095
240.0	.3025	.1500	4640.0	6639.0	114.8	22.85	31.18	1165.0	1.00091
250.0	.2904	.1440	4867.0	6950.0	116.0	22.57	30.91	1191.0	1.00088
260.0	.2792	.1385	5092.0	7258.0	117.2	22.33	30.66	1216.0	1.00084
270.0	.2689	.1334	5314.0	7563.0	118.4	22.11	30.44	1241.0	1.00081
280.0	.2593	.1286	5534.0	7866.0	119.5	21.92	30.25	1265.0	1.00078
300.0	.2420	.1201	5969.0	8468.0	121.6	21.62	29.94	1311.0	1.00073
320.0	.2269	.1126	6399.0	9065.0	123.5	21.40	29.72	1356.0	1.00068
340.0	.2136	.1059	6826.0	9657.0	125.3	21.25	29.57	1399.0	1.00064
360.0	.2017	.1001	7250.0	10250.0	127.0	21.14	29.46	1441.0	1.00061
380.0	.1911	.09481	7672.0	10840.0	128.6	21.07	29.39	1481.0	1.00058
400.0	.1816	.09008	8093.0	11420.0	130.1	21.02	29.34	1520.0	1.00055

.40 MPa isobar

13.93*	77.22	38.30	-622.0	-611.6	10.04	10.96	15.23	1361.0	1.25228
14.0	77.17	38.28	-621.0	-610.6	10.11	10.84	15.11	1358.0	1.25209
15.0	76.33	37.86	-606.6	-596.0	11.12	9.84	14.28	1317.0	1.24916
16.0	75.47	37.44	-592.4	-581.7	12.04	9.78	14.57	1275.0	1.24613
18.0	73.61	36.51	-561.8	-550.8	13.86	10.52	16.43	1197.0	1.23962
20.0	71.52	35.48	-526.9	-515.6	15.71	11.34	18.84	1126.0	1.23233

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
22.0	69.12	34.29	-486.9	-475.3	17.63	11.98	21.58	1055.0	1.22399
23.0	67.77	33.62	-464.8	-452.9	18.63	12.23	23.16	1016.0	1.21932
24.0	66.29	32.88	-441.0	-428.9	19.65	12.44	24.98	973.7	1.21421
25.0	64.65	32.07	-415.3	-402.8	20.71	12.64	27.19	927.0	1.20856
25.963 ^b	62.87	31.18	-388.2	-375.4	21.79	12.83	29.91	876.1	1.20244
25.963 ^b	4.871	2.416	246.2	411.7	52.10	14.16	34.15	373.8	1.01476
30.0	3.784	1.877	317.9	531.1	56.38	13.10	26.73	424.8	1.01145
31.0	3.604	1.788	333.7	557.4	57.25	12.98	25.95	435.3	1.01090
32.0	3.445	1.709	348.9	583.0	58.06	12.89	25.33	445.3	1.01042
33.0	3.302	1.638	363.9	608.1	58.83	12.82	24.83	454.8	1.00999
34.0	3.173	1.574	378.5	632.7	59.57	12.76	24.42	464.0	1.00959
35.0	3.055	1.515	393.0	657.0	60.27	12.72	24.08	472.8	1.00924
36.0	2.947	1.462	407.2	680.9	60.94	12.68	23.79	481.3	1.00891
38.0	2.755	1.366	435.2	728.0	62.22	12.63	23.32	497.7	1.00833
40.0	2.589	1.284	462.8	774.2	63.40	12.60	22.98	513.1	1.00782
42.0	2.444	1.212	490.0	819.9	64.52	12.60	22.73	527.7	1.00738
44.0	2.316	1.149	517.0	865.2	65.57	12.61	22.53	541.7	1.00700
46.0	2.202	1.092	543.8	910.1	66.57	12.63	22.38	555.1	1.00665
48.0	2.099	1.041	570.5	954.7	67.52	12.66	22.27	568.1	1.00634
50.0	2.006	.9950	597.1	999.2	68.42	12.70	22.18	580.5	1.00606
52.0	1.921	.9530	623.7	1043.0	69.29	12.75	22.13	592.4	1.00580
54.0	1.844	.9146	650.4	1088.0	70.13	12.81	22.10	603.9	1.00557
56.0	1.773	.8793	677.0	1132.0	70.93	12.90	22.11	614.8	1.00535
58.0	1.707	.8468	703.8	1176.0	71.71	13.00	22.14	625.3	1.00515
60.0	1.646	.8167	730.7	1220.0	72.46	13.12	22.20	635.4	1.00497
62.0	1.590	.7888	757.9	1265.0	73.19	13.26	22.28	645.0	1.00480
64.0	1.538	.7628	785.2	1310.0	73.90	13.42	22.40	654.2	1.00464
70.0	1.400	.6944	869.3	1445.0	75.92	14.02	22.87	679.4	1.00422
75.0	1.303	.6464	942.2	1561.0	77.52	14.64	23.42	698.2	1.00393
80.0	1.219	.6047	1018.0	1680.0	79.05	15.35	24.07	715.3	1.00368
85.0	1.145	.5682	1098.0	1802.0	80.53	16.14	24.80	731.2	1.00346
90.0	1.080	.5359	1181.0	1928.0	81.97	16.98	25.60	746.2	1.00326
95.0	1.022	.5072	1269.0	2058.0	83.38	17.84	26.43	760.7	1.00309
100.0	.9706	.4814	1361.0	2192.0	84.76	18.71	27.27	774.7	1.00293
105.0	.9237	.4582	1458.0	2331.0	86.11	19.57	28.10	788.6	1.00279
110.0	.8812	.4371	1558.0	2473.0	87.43	20.39	28.90	802.3	1.00266
115.0	.8425	.4179	1662.0	2619.0	88.73	21.16	29.65	816.0	1.00254
120.0	.8071	.4004	1770.0	2769.0	90.01	21.86	30.33	829.8	1.00243
125.0	.7746	.3842	1882.0	2923.0	91.26	22.47	30.93	843.8	1.00234
130.0	.7446	.3694	1996.0	3079.0	92.48	23.01	31.45	857.8	1.00225
140.0	.6912	.3429	2231.0	3397.0	94.85	23.85	32.27	886.0	1.00208
150.0	.6449	.3199	2473.0	3723.0	97.09	24.37	32.78	914.5	1.00195
160.0	.6045	.2999	2718.0	4052.0	99.22	24.64	33.03	943.1	1.00182
170.0	.5689	.2822	2965.0	4383.0	101.2	24.69	33.07	971.8	1.00172
180.0	.5373	.2665	3212.0	4713.0	103.1	24.58	32.95	1000.0	1.00162
190.0	.5090	.2525	3457.0	5041.0	104.9	24.37	32.73	1029.0	1.00154
200.0	.4835	.2399	3700.0	5367.0	106.6	24.09	32.45	1057.0	1.00146
210.0	.4605	.2284	3939.0	5690.0	108.1	23.78	32.13	1085.0	1.00139
220.0	.4396	.2181	4176.0	6010.0	109.6	23.46	31.81	1112.0	1.00133
230.0	.4205	.2086	4409.0	6327.0	111.0	23.15	31.49	1139.0	1.00127
240.0	.4030	.1999	4639.0	6640.0	112.4	22.85	31.19	1166.0	1.00122
250.0	.3869	.1919	4866.0	6950.0	113.6	22.58	30.92	1191.0	1.00117
260.0	.3720	.1846	5091.0	7258.0	114.8	22.33	30.67	1217.0	1.00112
270.0	.3583	.1777	5313.0	7564.0	116.0	22.11	30.45	1241.0	1.00108
280.0	.3455	.1714	5533.0	7867.0	117.1	21.92	30.25	1266.0	1.00104
300.0	.3225	.1600	5969.0	8469.0	119.2	21.62	29.95	1312.0	1.00097
320.0	.3024	.1500	6399.0	9066.0	121.1	21.40	29.73	1357.0	1.00091
340.0	.2846	.1412	6826.0	9659.0	122.9	21.25	29.57	1400.0	1.00086
360.0	.2688	.1334	7249.0	10250.0	124.6	21.14	29.47	1441.0	1.00081
380.0	.2547	.1263	7672.0	10840.0	126.2	21.07	29.39	1482.0	1.00077
400.0	.2420	.1200	8093.0	11420.0	127.7	21.02	29.34	1520.0	1.00073

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
.50 MPa isobar									
13.97 ^a	77.27	38.33	-621.9	-608.9	10.05	10.96	15.15	1357.0	1.25245
14.0	77.24	38.32	-621.4	-608.4	10.08	10.90	15.10	1356.0	1.25235
15.0	76.41	37.91	-607.0	-593.8	11.09	9.88	14.25	1316.0	1.24945
16.0	75.56	37.48	-592.8	-579.5	12.01	9.81	14.54	1276.0	1.24645
18.0	73.72	36.57	-562.4	-548.7	13.82	10.53	16.38	1200.0	1.24000
20.0	71.65	35.54	-527.7	-513.7	15.67	11.35	18.75	1131.0	1.23278
22.0	69.28	34.37	-488.1	-473.5	17.58	11.98	21.44	1061.0	1.22455
23.0	67.95	33.71	-466.2	-451.3	18.56	12.22	22.98	1024.0	1.21994
24.0	66.50	32.99	-442.7	-427.5	19.58	12.44	24.73	982.7	1.21493
25.0	64.90	32.19	-417.3	-401.8	20.63	12.63	26.83	937.6	1.20941
26.0	63.09	31.30	-389.6	-373.6	21.73	12.82	29.50	886.7	1.20321
27.0	61.01	30.26	-359.0	-342.4	22.91	13.02	33.16	827.9	1.19609
27.1	60.78	30.15	-355.7	-339.1	23.03	13.04	33.61	821.4	1.19531
27.125 ^b	60.73	30.12	-354.9	-338.3	23.06	13.05	33.72	819.9	1.19513
27.125 ^b	6.130	3.041	242.2	406.6	50.52	14.43	38.59	375.4	1.01860
30.0	4.985	2.473	299.8	502.0	53.87	13.40	29.70	416.0	1.01510
31.0	4.714	2.339	317.2	531.0	54.82	13.21	28.30	427.7	1.01428
32.0	4.480	2.222	333.8	558.7	55.70	13.07	27.25	438.6	1.01357
33.0	4.275	2.120	349.8	585.6	56.52	12.96	26.44	448.9	1.01294
34.0	4.092	2.030	365.3	611.7	57.30	12.88	25.79	458.8	1.01238
35.0	3.927	1.948	380.5	637.2	58.04	12.82	25.27	468.2	1.01188
36.0	3.778	1.874	395.4	662.2	58.75	12.76	24.83	477.2	1.01143
37.0	3.642	1.806	410.1	686.9	59.42	12.72	24.46	485.9	1.01102
38.0	3.517	1.744	424.6	711.2	60.07	12.69	24.15	494.3	1.00964
40.0	3.294	1.634	453.0	759.0	61.30	12.65	23.66	510.4	1.00996
42.0	3.102	1.538	480.9	805.9	62.44	12.64	23.30	525.5	1.00938
44.0	2.933	1.455	508.5	852.2	63.52	12.64	23.02	539.9	1.00886
46.0	2.783	1.380	535.9	898.0	64.54	12.65	22.81	553.7	1.00841
48.0	2.649	1.314	563.0	943.5	65.51	12.68	22.64	566.9	1.00801
50.0	2.529	1.254	590.0	988.6	66.43	12.71	22.52	579.6	1.00764
52.0	2.419	1.200	617.0	1034.0	67.31	12.76	22.43	591.7	1.00731
54.0	2.320	1.151	643.9	1078.0	68.15	12.83	22.38	603.3	1.00701
56.0	2.229	1.106	670.9	1123.0	68.97	12.91	22.36	614.5	1.00673
58.0	2.145	1.064	697.9	1168.0	69.75	13.01	22.37	625.1	1.00648
60.0	2.067	1.026	725.1	1213.0	70.51	13.13	22.41	635.3	1.00624
62.0	1.996	.9900	752.4	1258.0	71.25	13.27	22.48	645.0	1.00603
64.0	1.929	.9569	780.0	1303.0	71.96	13.43	22.58	654.3	1.00583
66.0	1.867	.9260	807.9	1348.0	72.66	13.61	22.70	663.1	1.00564
70.0	1.754	.8702	864.6	1439.0	74.00	14.03	23.02	679.7	1.00530
75.0	1.632	.8094	937.9	1556.0	75.61	14.65	23.54	698.6	1.00493
80.0	1.526	.7569	1014.0	1675.0	77.15	15.36	24.18	715.8	1.00461
85.0	1.433	.7109	1094.0	1798.0	78.63	16.15	24.90	731.8	1.00433
90.0	1.351	.6703	1178.0	1924.0	80.08	16.98	25.68	746.9	1.00408
95.0	1.279	.6342	1266.0	2054.0	81.49	17.85	26.50	761.3	1.00386
100.0	1.213	.6019	1358.0	2189.0	82.87	18.72	27.34	775.4	1.00366
105.0	1.155	.5727	1455.0	2328.0	84.22	19.58	28.16	789.3	1.00348
110.0	1.101	.5463	1555.0	2471.0	85.55	20.40	28.95	803.1	1.00332
115.0	1.053	.5223	1660.0	2617.0	86.86	21.17	29.70	816.8	1.00318
120.0	1.009	.5003	1768.0	2767.0	88.14	21.86	30.38	830.7	1.00304
125.0	.9678	.4801	1879.0	2921.0	89.39	22.48	30.97	844.6	1.00292
130.0	.9303	.4615	1994.0	3077.0	90.61	23.01	31.49	858.6	1.00281
140.0	.8635	.4283	2229.0	3396.0	92.98	23.85	32.30	886.9	1.00260
150.0	.8057	.3996	2471.0	3722.0	95.23	24.38	32.81	915.4	1.00243
160.0	.7552	.3746	2717.0	4051.0	97.35	24.64	33.05	944.0	1.00228
170.0	.7107	.3525	2964.0	4382.0	99.36	24.69	33.09	972.7	1.00214
180.0	.6711	.3329	3211.0	4713.0	101.2	24.59	32.97	1001.0	1.00202
190.0	.6358	.3154	3456.0	5041.0	103.0	24.37	32.75	1030.0	1.00192
200.0	.6040	.2996	3699.0	5368.0	104.7	24.09	32.46	1058.0	1.00182
210.0	.5753	.2854	3938.0	5691.0	106.3	23.78	32.15	1086.0	1.00174
220.0	.5491	.2724	4175.0	6010.0	107.8	23.46	31.82	1113.0	1.00166
230.0	.5253	.2606	4408.0	6327.0	109.2	23.15	31.50	1140.0	1.00158

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
240.0	.5034	.2497	4638.0	6640.0	110.5	22.85	31.20	1166.0	1.00152
250.0	.4833	.2397	4866.0	6951.0	111.8	22.58	30.92	1192.0	1.00146
260.0	.4647	.2305	5090.0	7259.0	113.0	22.33	30.67	1218.0	1.00140
270.0	.4476	.2220	5313.0	7565.0	114.1	22.12	30.45	1242.0	1.00135
280.0	.4316	.2141	5533.0	7868.0	115.2	21.93	30.26	1266.0	1.00130
300.0	.4029	.1999	5968.0	8470.0	117.3	21.62	29.95	1313.0	1.00122
320.0	.3778	.1874	6399.0	9067.0	119.2	21.40	29.73	1358.0	1.00114
340.0	.3556	.1764	6825.0	9660.0	121.0	21.25	29.58	1401.0	1.00107
360.0	.3359	.1666	7249.0	10250.0	122.7	21.15	29.47	1442.0	1.00101
380.0	.3182	.1579	7671.0	10840.0	124.3	21.07	29.40	1482.0	1.00096
400.0	.3024	.1500	8092.0	11430.0	125.8	21.02	29.34	1521.0	1.00091

.60 MPa isobar

14.00 ^a	77.31	38.35	-621.8	-606.1	10.06	10.96	15.08	1354.0	1.25261
15.0	76.50	37.95	-607.4	-591.6	11.06	9.92	14.23	1316.0	1.24974
16.0	75.65	37.53	-593.3	-577.3	11.98	9.84	14.51	1277.0	1.24677
18.0	73.83	36.62	-563.0	-546.6	13.79	10.55	16.32	1203.0	1.24038
20.0	71.78	35.61	-528.6	-511.7	15.62	11.36	18.67	1136.0	1.23323
22.0	69.44	34.44	-489.2	-471.8	17.52	11.98	21.31	1068.0	1.22509
23.0	68.13	33.79	-467.5	-449.7	18.50	12.22	22.80	1031.0	1.22056
24.0	66.70	33.09	-444.3	-426.1	19.51	12.43	24.50	991.4	1.21563
25.0	65.13	32.31	-419.2	-400.6	20.55	12.62	26.51	947.8	1.21022
26.0	63.38	31.44	-392.0	-372.9	21.64	12.80	29.00	898.9	1.20420
27.0	61.37	30.44	-362.1	-342.4	22.79	12.99	32.36	842.9	1.19732
27.5	60.24	29.88	-345.7	-325.6	23.40	13.09	34.58	811.2	1.19346
28.0	58.99	29.26	-328.2	-307.7	24.05	13.22	37.40	776.4	1.18919
28.133 ^b	58.64	29.09	-323.3	-302.7	24.23	13.25	38.27	766.7	1.18800
28.133 ^b	7.467	3.704	235.4	397.4	49.10	14.70	44.26	376.1	1.02268
30.0	6.368	3.159	278.9	468.9	51.57	13.79	34.15	406.1	1.01932
31.0	5.960	2.956	298.7	501.6	52.64	13.51	31.58	419.4	1.01807
32.0	5.621	2.788	317.1	532.3	53.62	13.30	29.79	431.5	1.01704
33.0	5.332	2.645	334.5	561.4	54.51	13.14	28.48	442.8	1.01616
34.0	5.079	2.520	351.2	589.3	55.35	13.02	27.48	453.4	1.01539
35.0	4.857	2.409	367.4	616.4	56.13	12.93	26.69	463.4	1.01471
36.0	4.657	2.310	383.1	642.8	56.87	12.86	26.05	473.0	1.01410
37.0	4.477	2.221	398.4	668.5	57.58	12.80	25.53	482.2	1.01356
38.0	4.314	2.140	413.5	693.8	58.25	12.75	25.09	491.0	1.01306
40.0	4.026	1.997	442.9	743.3	59.52	12.69	24.41	507.8	1.01218
42.0	3.780	1.875	471.6	791.6	60.70	12.67	23.92	523.4	1.01144
44.0	3.566	1.769	499.9	839.1	61.81	12.67	23.55	538.2	1.01079
46.0	3.378	1.676	527.8	885.9	62.85	12.67	23.26	552.3	1.01022
48.0	3.210	1.593	555.4	932.1	63.83	12.69	23.04	565.8	1.00971
50.0	3.061	1.518	582.8	978.0	64.77	12.73	22.87	578.7	1.00925
52.0	2.925	1.451	610.2	1024.0	65.66	12.78	22.74	591.1	1.00884
54.0	2.802	1.390	637.4	1069.0	66.52	12.84	22.66	602.9	1.00847
56.0	2.690	1.334	664.7	1114.0	67.34	12.92	22.61	614.2	1.00813
58.0	2.587	1.283	692.0	1160.0	68.14	13.02	22.60	624.9	1.00782
60.0	2.492	1.236	719.4	1205.0	68.90	13.14	22.62	635.2	1.00753
62.0	2.405	1.193	747.0	1250.0	69.64	13.28	22.68	645.0	1.00726
64.0	2.323	1.152	774.8	1295.0	70.37	13.44	22.76	654.4	1.00702
66.0	2.247	1.115	802.9	1341.0	71.07	13.62	22.87	663.3	1.00679
70.0	2.110	1.047	860.0	1433.0	72.42	14.04	23.17	680.0	1.00637
75.0	1.962	.9731	933.6	1550.0	74.04	14.66	23.67	699.0	1.00592
80.0	1.833	.9094	1010.0	1670.0	75.58	15.37	24.29	716.3	1.00554
85.0	1.721	.8539	1091.0	1793.0	77.08	16.16	24.99	732.4	1.00520
90.0	1.623	.8049	1175.0	1920.0	78.53	16.99	25.77	747.5	1.00490
95.0	1.535	.7613	1263.0	2051.0	79.94	17.86	26.58	762.0	1.00463
100.0	1.456	.7224	1355.0	2186.0	81.33	18.73	27.40	776.2	1.00440
105.0	1.385	.6873	1452.0	2325.0	82.68	19.58	28.22	790.1	1.00418
110.0	1.321	.6555	1553.0	2468.0	84.01	20.41	29.01	803.8	1.00399
115.0	1.263	.6266	1657.0	2615.0	85.32	21.17	29.75	817.6	1.00381
120.0	1.210	.6001	1766.0	2765.0	86.60	21.87	30.42	831.5	1.00365

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
125.0	1.161	.5759	1877.0	2919.0	87.85	22.49	31.02	845.4	1.00350
130.0	1.116	.5535	1991.0	3075.0	89.08	23.02	31.53	859.5	1.00337
140.0	1.036	.5137	2227.0	3395.0	91.45	23.86	32.33	887.7	1.00312
150.0	.9662	.4793	2469.0	3721.0	93.70	24.38	32.83	916.3	1.00291
160.0	.9056	.4492	2715.0	4051.0	95.83	24.65	33.08	944.9	1.00273
170.0	.8522	.4227	2962.0	4382.0	97.83	24.70	33.11	973.6	1.00257
180.0	.8048	.3992	3210.0	4712.0	99.72	24.59	32.99	1002.0	1.00243
190.0	.7624	.3782	3455.0	5041.0	101.5	24.38	32.77	1031.0	1.00230
200.0	.7243	.3593	3698.0	5368.0	103.2	24.10	32.48	1059.0	1.00218
210.0	.6898	.3422	3937.0	5691.0	104.8	23.79	32.16	1087.0	1.00208
220.0	.6585	.3266	4174.0	6011.0	106.2	23.47	31.83	1114.0	1.00199
230.0	.6299	.3125	4407.0	6327.0	107.6	23.15	31.51	1141.0	1.00190
240.0	.6037	.2995	4637.0	6641.0	109.0	22.86	31.21	1167.0	1.00182
250.0	.5796	.2875	4865.0	6952.0	110.3	22.58	30.93	1193.0	1.00175
260.0	.5573	.2765	5090.0	7260.0	111.5	22.34	30.68	1218.0	1.00168
270.0	.5367	.2662	5312.0	7565.0	112.6	22.12	30.46	1243.0	1.00162
280.0	.5176	.2568	5532.0	7869.0	113.7	21.93	30.27	1267.0	1.00156
300.0	.4832	.2397	5968.0	8471.0	115.8	21.62	29.96	1314.0	1.00146
320.0	.4531	.2247	6398.0	9068.0	117.7	21.40	29.74	1359.0	1.00137
340.0	.4265	.2115	6825.0	9661.0	119.5	21.25	29.58	1402.0	1.00129
360.0	.4028	.1998	7249.0	10250.0	121.2	21.15	29.47	1443.0	1.00122
380.0	.3817	.1893	7671.0	10840.0	122.8	21.08	29.40	1483.0	1.00115
400.0	.3626	.1799	8092.0	11430.0	124.3	21.02	29.34	1522.0	1.00109

.80 MPa isobar

14.07 ^a	77.41	38.40	-621.5	-600.7	10.07	10.96	14.94	1349.0	1.25296
15.0	76.66	38.03	-608.2	-587.2	11.00	10.00	14.18	1315.0	1.25032
16.0	75.83	37.62	-594.2	-573.0	11.92	9.89	14.44	1279.0	1.24740
18.0	74.04	36.73	-564.2	-542.5	13.72	10.57	16.22	1209.0	1.24112
20.0	72.03	35.73	-530.2	-507.8	15.54	11.36	18.51	1146.0	1.23411
22.0	69.74	34.60	-491.4	-468.3	17.42	11.97	21.05	1081.0	1.22616
23.0	68.47	33.97	-470.1	-446.5	18.39	12.21	22.48	1046.0	1.22175
24.0	67.09	33.28	-447.3	-423.3	19.38	12.42	24.07	1008.0	1.21698
25.0	65.59	32.53	-422.9	-398.3	20.40	12.60	25.91	967.1	1.21178
26.0	63.92	31.71	-396.5	-371.3	21.45	12.76	28.15	921.6	1.20605
27.0	62.04	30.77	-367.8	-341.8	22.57	12.93	31.02	870.4	1.19960
27.5	60.99	30.26	-352.3	-325.8	23.15	13.03	32.83	841.9	1.19603
28.0	59.86	29.69	-335.8	-308.9	23.76	13.13	35.03	811.1	1.19216
28.5	58.61	29.07	-318.2	-290.7	24.41	13.24	37.80	777.3	1.18791
29.0	57.21	28.38	-299.1	-270.9	25.10	13.38	41.48	739.7	1.18316
29.5	55.60	27.58	-278.0	-249.0	25.85	13.55	46.76	696.9	1.17770
29.836 ^b	54.35	26.96	-262.2	-232.5	26.40	13.71	51.95	664.3	1.17348
29.836 ^b	10.50	5.207	213.8	367.4	46.50	15.31	62.69	375.8	1.03199
30.0	10.25	5.085	220.0	377.4	46.83	15.14	58.62	379.6	1.03123
30.2	9.982	4.951	227.1	388.7	47.21	14.96	54.67	384.0	1.03040
30.5	9.629	4.776	236.9	404.4	47.73	14.73	50.15	390.0	1.02932
31.0	9.136	4.532	251.5	428.0	48.50	14.41	44.88	399.2	1.02780
31.5	8.727	4.329	264.7	449.5	49.18	14.16	41.23	407.6	1.02654
32.0	8.376	4.155	276.9	469.4	49.81	13.95	38.53	415.3	1.02547
32.5	8.068	4.002	288.2	488.1	50.39	13.77	36.46	422.5	1.02452
33.0	7.795	3.867	299.0	505.9	50.93	13.63	34.80	429.3	1.02369
33.5	7.549	3.745	309.3	523.0	51.45	13.50	33.45	435.8	1.02293
34.0	7.325	3.634	319.2	539.4	51.93	13.40	32.32	441.9	1.02225
35.0	6.931	3.438	338.1	570.8	52.84	13.22	30.56	453.6	1.02104
36.0	6.592	3.270	356.0	600.7	53.69	13.09	29.23	464.4	1.02000
37.0	6.295	3.122	373.2	629.4	54.47	12.99	28.21	474.7	1.01910
38.0	6.031	2.992	389.7	657.2	55.21	12.91	27.39	484.4	1.01829
39.0	5.794	2.874	405.9	684.2	55.92	12.84	26.72	493.7	1.01757
40.0	5.580	2.768	421.6	710.6	56.58	12.80	26.17	502.6	1.01691
42.0	5.205	2.582	452.2	762.1	57.84	12.75	25.33	519.3	1.01577
44.0	4.886	2.424	482.0	812.1	59.00	12.73	24.71	535.0	1.01480

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
46.0	4.609	2.287	511.1	861.0	60.09	12.72	24.24	549.8	1.01396
48.0	4.367	2.166	539.8	909.1	61.11	12.73	23.88	563.8	1.01322
50.0	4.152	2.060	568.2	956.6	62.08	12.76	23.61	577.2	1.01257
52.0	3.960	1.964	596.3	1004.0	63.01	12.80	23.40	590.0	1.01198
54.0	3.786	1.878	624.3	1050.0	63.89	12.87	23.25	602.1	1.01146
56.0	3.629	1.800	652.2	1097.0	64.73	12.94	23.14	613.7	1.01098
58.0	3.485	1.729	680.1	1143.0	65.54	13.04	23.08	624.7	1.01054
60.0	3.353	1.663	708.0	1189.0	66.32	13.16	23.06	635.2	1.01014
62.0	3.232	1.603	736.1	1235.0	67.08	13.30	23.08	645.2	1.00977
64.0	3.119	1.547	764.3	1281.0	67.81	13.46	23.13	654.8	1.00943
66.0	3.015	1.496	792.8	1328.0	68.52	13.64	23.21	663.8	1.00911
68.0	2.918	1.447	821.5	1374.0	69.22	13.84	23.33	672.5	1.00882
70.0	2.827	1.403	850.6	1421.0	69.90	14.06	23.47	680.8	1.00855
75.0	2.625	1.302	925.0	1539.0	71.53	14.67	23.92	700.0	1.00793
80.0	2.451	1.216	1002.0	1660.0	73.09	15.39	24.51	717.5	1.00740
85.0	2.299	1.140	1083.0	1785.0	74.60	16.17	25.19	733.6	1.00695
90.0	2.166	1.074	1168.0	1912.0	76.06	17.01	25.94	748.9	1.00654
95.0	2.048	1.016	1256.0	2044.0	77.48	17.87	26.73	763.5	1.00618
100.0	1.942	.9634	1349.0	2180.0	78.87	18.74	27.54	777.6	1.00586
105.0	1.847	.9163	1446.0	2319.0	80.24	19.60	28.34	791.6	1.00558
110.0	1.761	.8737	1547.0	2463.0	81.57	20.42	29.12	805.4	1.00532
115.0	1.683	.8350	1652.0	2611.0	82.88	21.19	29.85	819.2	1.00508
120.0	1.612	.7996	1761.0	2761.0	84.17	21.88	30.51	833.1	1.00487
125.0	1.547	.7671	1873.0	2916.0	85.43	22.50	31.10	847.1	1.00467
130.0	1.486	.7373	1987.0	3072.0	86.66	23.03	31.60	861.2	1.00449
140.0	1.379	.6841	2223.0	3393.0	89.03	23.87	32.40	889.5	1.00416
150.0	1.287	.6382	2466.0	3719.0	91.28	24.39	32.89	918.0	1.00388
160.0	1.206	.5981	2712.0	4049.0	93.41	24.66	33.13	946.7	1.00364
170.0	1.135	.5628	2960.0	4381.0	95.42	24.71	33.15	975.5	1.00342
180.0	1.072	.5315	3207.0	4712.0	97.32	24.60	33.03	1004.0	1.00323
190.0	1.015	.5035	3452.0	5041.0	99.10	24.38	32.80	1033.0	1.00306
200.0	.9643	.4783	3695.0	5368.0	100.8	24.11	32.51	1061.0	1.00291
210.0	.9184	.4556	3935.0	5691.0	102.4	23.79	32.19	1089.0	1.00277
220.0	.8767	.4349	4172.0	6011.0	103.8	23.47	31.85	1116.0	1.00264
230.0	.8387	.4160	4405.0	6328.0	105.2	23.16	31.53	1143.0	1.00253
240.0	.8038	.3987	4636.0	6642.0	106.6	22.86	31.23	1169.0	1.00242
250.0	.7717	.3828	4863.0	6953.0	107.9	22.59	30.95	1195.0	1.00233
260.0	.7421	.3681	5088.0	7261.0	109.1	22.34	30.70	1220.0	1.00224
270.0	.7147	.3545	5311.0	7567.0	110.2	22.12	30.48	1245.0	1.00216
280.0	.6893	.3419	5531.0	7871.0	111.3	21.93	30.28	1269.0	1.00208
300.0	.6435	.3192	5967.0	8473.0	113.4	21.63	29.97	1316.0	1.00194
320.0	.6034	.2993	6397.0	9070.0	115.3	21.41	29.74	1360.0	1.00182
340.0	.5680	.2818	6824.0	9663.0	117.1	21.26	29.59	1403.0	1.00171
360.0	.5365	.2662	7248.0	10250.0	118.8	21.15	29.48	1445.0	1.00162
380.0	.5084	.2522	7671.0	10840.0	120.4	21.08	29.40	1485.0	1.00153
400.0	.4831	.2396	8092.0	11430.0	121.9	21.03	29.35	1523.0	1.00146

1.00 MPa isobar

14.13*	77.51	38.45	-621.3	-595.2	10.09	10.95	14.80	1344.0	1.25330
15.0	76.83	38.11	-609.0	-582.8	10.95	10.08	14.13	1315.0	1.25089
16.0	76.01	37.70	-595.1	-568.6	11.86	9.94	14.37	1281.0	1.24802
18.0	74.25	36.83	-565.4	-538.3	13.65	10.59	16.11	1216.0	1.24185
20.0	72.27	35.85	-531.7	-503.8	15.46	11.37	18.36	1155.0	1.23496
22.0	70.04	34.74	-493.5	-464.7	17.32	11.97	20.82	1093.0	1.22718
23.0	68.80	34.13	-472.5	-443.2	18.28	12.20	22.18	1060.0	1.22289
24.0	67.47	33.47	-450.2	-420.3	19.25	12.40	23.68	1024.0	1.21827
25.0	66.01	32.75	-426.3	-395.8	20.25	12.58	25.39	985.2	1.21326
26.0	64.42	31.96	-400.7	-369.4	21.29	12.74	27.42	942.7	1.20777
27.0	62.64	31.07	-373.0	-340.8	22.37	12.89	29.93	895.3	1.20167
28.0	60.62	30.07	-342.5	-309.3	23.51	13.06	33.26	841.5	1.19476
28.5	59.49	29.51	-326.0	-292.1	24.12	13.15	35.43	811.5	1.19089

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C, J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
29.0	58.24	28.89	-308.4	-273.7	24.76	13.26	38.13	778.8	1.18666
29.5	56.86	28.20	-289.3	-253.8	25.44	13.39	41.66	742.8	1.18196
30.0	55.28	27.42	-268.3	-231.9	26.18	13.55	46.59	702.3	1.17662
30.5	53.40	26.49	-244.6	-206.8	27.00	13.77	54.23	655.5	1.17030
30.6	52.98	26.28	-239.3	-201.3	27.19	13.82	56.34	645.1	1.16887
30.8	52.06	25.82	-228.3	-189.5	27.57	13.94	61.52	622.9	1.16579
31.0	51.02	25.31	-216.1	-176.5	27.99	14.09	68.70	598.4	1.16231
31.2	49.81	24.71	-202.3	-161.8	28.46	14.28	79.53	570.6	1.15825
31.256 ^b	49.45	24.53	-198.3	-157.5	28.60	14.33	83.31	562.8	1.15707
31.256 ^b	14.40	7.141	178.2	318.3	43.82	16.04	108.7	374.1	1.04406
35.0	9.410	4.668	303.5	517.7	49.90	13.63	36.85	443.0	1.02864
35.5	9.109	4.519	314.5	535.8	50.41	13.51	35.29	449.4	1.02772
36.0	8.837	4.383	324.9	553.1	50.90	13.41	34.00	455.6	1.02688
37.0	8.358	4.146	344.8	586.0	51.80	13.24	31.98	467.1	1.02541
38.0	7.948	3.943	363.6	617.2	52.63	13.11	30.47	477.9	1.02416
39.0	7.590	3.765	381.5	647.1	53.41	13.00	29.30	488.1	1.02306
40.0	7.273	3.608	398.7	675.9	54.14	12.93	28.38	497.6	1.02209
41.0	6.989	3.467	415.4	703.9	54.83	12.88	27.63	506.8	1.02122
42.0	6.732	3.339	431.7	731.2	55.48	12.84	27.01	515.5	1.02043
43.0	6.497	3.223	447.7	757.9	56.11	12.81	26.49	523.9	1.01972
44.0	6.283	3.116	463.3	784.2	56.72	12.79	26.05	532.1	1.01906
46.0	5.901	2.927	493.9	835.6	57.86	12.77	25.34	547.6	1.01790
48.0	5.571	2.764	523.8	885.7	58.93	12.78	24.81	562.2	1.01689
50.0	5.282	2.620	553.2	934.9	59.93	12.80	24.41	576.0	1.01601
52.0	5.025	2.493	582.2	983.4	60.88	12.83	24.10	589.2	1.01523
54.0	4.796	2.379	611.0	1031.0	61.79	12.89	23.86	601.7	1.01453
56.0	4.589	2.276	639.5	1079.0	62.65	12.97	23.69	613.5	1.01390
58.0	4.401	2.183	668.0	1126.0	63.48	13.07	23.58	624.8	1.01332
60.0	4.229	2.098	696.5	1173.0	64.28	13.18	23.51	635.5	1.01280
62.0	4.072	2.020	725.1	1220.0	65.05	13.32	23.49	645.7	1.01232
64.0	3.926	1.948	753.8	1267.0	65.79	13.48	23.51	655.3	1.01188
66.0	3.792	1.881	782.7	1314.0	66.52	13.66	23.56	664.5	1.01147
68.0	3.667	1.819	811.8	1361.0	67.22	13.86	23.65	673.3	1.01109
70.0	3.551	1.762	841.2	1409.0	67.91	14.07	23.77	681.7	1.01074
75.0	3.292	1.633	916.4	1529.0	69.56	14.69	24.18	701.1	1.00996
80.0	3.071	1.523	994.4	1651.0	71.14	15.40	24.73	718.7	1.00928
85.0	2.879	1.428	1076.0	1776.0	72.66	16.19	25.38	735.0	1.00870
90.0	2.710	1.344	1161.0	1905.0	74.13	17.02	26.10	750.3	1.00819
95.0	2.561	1.270	1250.0	2037.0	75.56	17.89	26.88	764.9	1.00774
100.0	2.428	1.204	1343.0	2174.0	76.96	18.76	27.67	779.2	1.00734
105.0	2.309	1.145	1441.0	2314.0	78.33	19.61	28.46	793.2	1.00697
110.0	2.201	1.092	1542.0	2458.0	79.67	20.43	29.23	807.0	1.00665
115.0	2.103	1.043	1647.0	2606.0	80.99	21.20	29.95	820.9	1.00635
120.0	2.013	.9987	1756.0	2758.0	82.28	21.90	30.60	834.8	1.00608
125.0	1.931	.9581	1868.0	2912.0	83.54	22.51	31.18	848.8	1.00583
130.0	1.856	.9207	1983.0	3069.0	84.77	23.04	31.68	862.9	1.00560
140.0	1.722	.8541	2219.0	3390.0	87.15	23.88	32.46	891.2	1.00520
150.0	1.606	.7967	2462.0	3717.0	89.41	24.40	32.94	919.8	1.00485
160.0	1.505	.7466	2709.0	4048.0	91.54	24.67	33.17	948.5	1.00454
170.0	1.416	.7026	2957.0	4380.0	93.55	24.71	33.20	977.3	1.00427
180.0	1.337	.6634	3204.0	4712.0	95.45	24.61	33.07	1006.0	1.00404
190.0	1.267	.6285	3450.0	5041.0	97.23	24.39	32.83	1034.0	1.00382
200.0	1.204	.5971	3693.0	5368.0	98.91	24.11	32.54	1063.0	1.00363
210.0	1.146	.5687	3933.0	5692.0	100.5	23.80	32.21	1090.0	1.00346
220.0	1.094	.5429	4170.0	6012.0	102.0	23.48	31.88	1118.0	1.00330
230.0	1.047	.5193	4404.0	6329.0	103.4	23.16	31.55	1145.0	1.00316
240.0	1.003	.4977	4634.0	6643.0	104.7	22.87	31.25	1171.0	1.00303
250.0	.9634	.4779	4862.0	6954.0	106.0	22.59	30.97	1197.0	1.00291
260.0	.9265	.4596	5087.0	7263.0	107.2	22.35	30.71	1222.0	1.00280
270.0	.8923	.4426	5309.0	7569.0	108.4	22.13	30.49	1247.0	1.00269
280.0	.8605	.4269	5530.0	7873.0	109.5	21.94	30.29	1271.0	1.00260
300.0	.8034	.3985	5966.0	8475.0	111.5	21.63	29.98	1317.0	1.00242
320.0	.7533	.3737	6396.0	9072.0	113.5	21.41	29.75	1362.0	1.00227

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
340.0	.7092	.3518	6823.0	9666.0	115.3	21.26	29.60	1405.0	1.00214
360.0	.6700	.3323	7248.0	10260.0	117.0	21.15	29.49	1446.0	1.00202
380.0	.6349	.3149	7670.0	10850.0	118.5	21.08	29.41	1486.0	1.00192
400.0	.6032	.2992	8091.0	11430.0	120.1	21.03	29.36	1525.0	1.00182
1.10 MPa isobar									
14.17 ^a	77.56	38.47	-621.1	-592.5	10.10	10.94	14.74	1342.0	1.25347
15.0	76.91	38.15	-609.4	-580.6	10.92	10.11	14.11	1315.0	1.25118
16.0	76.10	37.75	-595.5	-566.4	11.83	9.97	14.34	1282.0	1.24833
18.0	74.35	36.88	-566.0	-536.2	13.61	10.60	16.07	1219.0	1.24221
20.0	72.40	35.91	-532.5	-501.8	15.42	11.37	18.28	1159.0	1.23538
22.0	70.18	34.81	-494.5	-462.9	17.27	11.97	20.71	1099.0	1.22769
24.0	67.65	33.56	-451.5	-418.8	19.19	12.40	23.50	1031.0	1.21889
25.0	66.22	32.85	-427.9	-394.5	20.18	12.57	25.15	993.8	1.21396
26.0	64.66	32.07	-402.7	-368.4	21.21	12.72	27.09	952.6	1.20859
27.0	62.93	31.21	-375.4	-340.1	22.27	12.87	29.46	906.9	1.20264
28.0	60.97	30.24	-345.6	-309.2	23.40	13.03	32.53	855.4	1.19596
29.0	58.70	29.12	-312.4	-274.7	24.61	13.21	36.87	796.2	1.18822
29.5	57.39	28.47	-294.1	-255.5	25.26	13.33	39.88	762.6	1.18379
30.0	55.93	27.74	-274.3	-234.6	25.96	13.46	43.89	725.4	1.17883
30.5	54.24	26.91	-252.2	-211.3	26.73	13.64	49.63	683.5	1.17314
30.6	53.87	26.72	-247.5	-206.3	26.90	13.68	51.12	674.4	1.17188
30.8	53.08	26.33	-237.5	-195.7	27.24	13.78	54.59	655.2	1.16922
31.0	52.21	25.90	-226.9	-184.4	27.61	13.88	58.97	634.6	1.16630
31.2	51.25	25.42	-215.3	-172.1	28.01	14.01	64.74	612.2	1.16307
31.4	50.15	24.88	-202.6	-158.3	28.44	14.17	72.84	587.4	1.15941
31.6	48.86	24.24	-188.0	-142.6	28.94	14.37	85.31	559.3	1.15510
31.7	48.11	23.86	-179.8	-133.7	29.23	14.50	94.66	543.6	1.15259
31.8	47.25	23.44	-170.5	-123.6	29.54	14.64	108.0	526.1	1.14972
31.888 ^b	46.42	23.03	-161.8	-114.0	29.85	14.79	124.2	510.3	1.14698
31.888 ^b	17.05	8.460	151.0	281.1	42.23	16.48	172.9	373.0	1.05234
35.0	10.88	5.396	283.2	487.1	48.45	13.90	41.71	437.5	1.03316
35.5	10.48	5.197	295.6	507.3	49.03	13.74	39.30	444.4	1.03193
36.0	10.12	5.020	307.3	526.5	49.56	13.61	37.38	451.0	1.03083
36.5	9.801	4.862	318.5	544.7	50.07	13.49	35.81	457.3	1.02985
37.0	9.510	4.718	329.1	562.3	50.55	13.39	34.50	463.3	1.02895
38.0	9.000	4.465	349.3	595.7	51.44	13.23	32.44	474.7	1.02738
39.0	8.563	4.248	368.4	627.3	52.26	13.10	30.89	485.3	1.02604
40.0	8.181	4.058	386.5	657.6	53.03	13.01	29.70	495.3	1.02487
41.0	7.842	3.890	404.0	686.8	53.75	12.94	28.75	504.8	1.02383
42.0	7.538	3.739	421.0	715.2	54.43	12.90	27.97	513.8	1.02290
43.0	7.263	3.603	437.5	742.8	55.08	12.86	27.33	522.4	1.02206
44.0	7.013	3.479	453.7	769.9	55.70	12.83	26.80	530.8	1.02129
46.0	6.571	3.260	485.1	822.6	56.87	12.80	25.95	546.6	1.01994
48.0	6.192	3.072	515.7	873.8	57.96	12.80	25.31	561.5	1.01878
50.0	5.862	2.908	545.6	923.9	58.99	12.81	24.83	575.6	1.01778
52.0	5.570	2.763	575.1	973.2	59.95	12.85	24.46	588.9	1.01689
54.0	5.310	2.634	604.2	1022.0	60.87	12.91	24.18	601.5	1.01609
56.0	5.077	2.518	633.2	1070.0	61.75	12.98	23.98	613.5	1.01538
58.0	4.865	2.413	662.0	1118.0	62.58	13.08	23.83	624.9	1.01474
60.0	4.673	2.318	690.8	1165.0	63.39	13.19	23.74	635.7	1.01415
62.0	4.496	2.230	719.6	1213.0	64.17	13.33	23.70	645.9	1.01361
64.0	4.334	2.150	748.5	1260.0	64.92	13.49	23.70	655.7	1.01312
66.0	4.184	2.075	777.6	1308.0	65.65	13.67	23.74	664.9	1.01266
68.0	4.045	2.006	806.9	1355.0	66.36	13.87	23.81	673.8	1.01224
70.0	3.915	1.942	836.5	1403.0	67.05	14.08	23.92	682.2	1.01185
75.0	3.628	1.800	912.1	1523.0	68.72	14.70	24.31	701.7	1.01097
80.0	3.382	1.678	990.5	1646.0	70.30	15.41	24.84	719.4	1.01023
85.0	3.169	1.572	1072.0	1772.0	71.82	16.20	25.47	735.7	1.00958
90.0	2.983	1.480	1158.0	1901.0	73.30	17.03	26.19	751.0	1.00902
95.0	2.818	1.398	1247.0	2034.0	74.74	17.90	26.95	765.7	1.00852
100.0	2.671	1.325	1340.0	2171.0	76.14	18.77	27.74	780.0	1.00807

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
105.0	2.539	1.260	1438.0	2311.0	77.51	19.62	28.52	794.0	1.00767
110.0	2.420	1.201	1540.0	2456.0	78.86	20.44	29.28	807.9	1.00731
115.0	2.312	1.147	1645.0	2604.0	80.17	21.21	29.99	821.7	1.00699
120.0	2.214	1.098	1754.0	2756.0	81.46	21.90	30.65	835.7	1.00669
125.0	2.124	1.053	1866.0	2910.0	82.73	22.52	31.22	849.7	1.00641
130.0	2.041	1.012	1981.0	3068.0	83.96	23.05	31.72	863.8	1.00616
140.0	1.893	.9390	2217.0	3389.0	86.34	23.88	32.50	892.1	1.00572
150.0	1.766	.8758	2461.0	3716.0	88.60	24.41	32.97	920.7	1.00533
160.0	1.655	.8207	2707.0	4048.0	90.74	24.67	33.20	949.5	1.00499
170.0	1.557	.7723	2955.0	4380.0	92.75	24.72	33.22	978.2	1.00470
180.0	1.470	.7293	3203.0	4711.0	94.65	24.61	33.08	1007.0	1.00444
190.0	1.393	.6908	3449.0	5041.0	96.43	24.40	32.85	1035.0	1.00420
200.0	1.323	.6563	3692.0	5368.0	98.11	24.12	32.55	1064.0	1.00399
210.0	1.260	.6251	3932.0	5692.0	99.69	23.80	32.22	1091.0	1.00380
220.0	1.203	.5967	4169.0	6013.0	101.2	23.48	31.89	1119.0	1.00363
230.0	1.151	.5709	4403.0	6330.0	102.6	23.17	31.56	1146.0	1.00347
240.0	1.103	.5471	4633.0	6644.0	103.9	22.87	31.26	1172.0	1.00333
250.0	1.059	.5253	4861.0	6955.0	105.2	22.60	30.98	1198.0	1.00320
260.0	1.018	.5052	5086.0	7264.0	106.4	22.35	30.72	1223.0	1.00307
270.0	.9809	.4866	5309.0	7570.0	107.6	22.13	30.50	1248.0	1.00296
280.0	.9460	.4692	5529.0	7874.0	108.7	21.94	30.30	1272.0	1.00285
300.0	.8832	.4381	5965.0	8476.0	110.7	21.63	29.99	1318.0	1.00266
320.0	.8282	.4108	6396.0	9074.0	112.7	21.41	29.76	1363.0	1.00250
340.0	.7797	.3868	6823.0	9667.0	114.5	21.26	29.60	1406.0	1.00235
360.0	.7366	.3654	7247.0	10260.0	116.2	21.16	29.49	1447.0	1.00222
380.0	.6980	.3462	7670.0	10850.0	117.8	21.08	29.41	1487.0	1.00211
400.0	.6633	.3290	8091.0	11430.0	119.3	21.03	29.36	1526.0	1.00200

1.20 MPa isobar

14.20 ^a	77.61	38.50	-621.0	-589.8	10.11	10.94	14.67	1340.0	1.25365
15.0	76.99	38.19	-609.8	-578.4	10.89	10.14	14.08	1315.0	1.25146
16.0	76.18	37.79	-596.0	-564.2	11.80	9.99	14.31	1283.0	1.24863
18.0	74.45	36.93	-566.5	-534.0	13.58	10.61	16.02	1222.0	1.24256
20.0	72.51	35.97	-533.2	-499.9	15.38	11.37	18.21	1164.0	1.23579
22.0	70.33	34.89	-495.5	-461.1	17.22	11.97	20.60	1105.0	1.22818
24.0	67.82	33.64	-452.9	-417.2	19.13	12.39	23.33	1039.0	1.21950
25.0	66.42	32.95	-429.5	-393.1	20.12	12.56	24.93	1002.0	1.21465
26.0	64.89	32.19	-404.6	-367.3	21.13	12.71	26.78	962.2	1.20938
27.0	63.20	31.35	-377.7	-339.4	22.18	12.85	29.03	918.1	1.20358
28.0	61.30	30.41	-348.5	-309.0	23.28	13.00	31.88	868.7	1.19709
29.0	59.12	29.33	-316.2	-275.3	24.47	13.17	35.79	812.4	1.18966
29.5	57.89	28.72	-298.6	-256.8	25.10	13.27	38.41	780.8	1.18546
30.0	56.52	28.04	-279.6	-236.8	25.77	13.39	41.77	746.4	1.18083
30.5	54.97	27.27	-258.8	-214.8	26.50	13.54	46.33	708.1	1.17560
31.0	53.17	26.37	-235.6	-190.1	27.30	13.74	53.07	664.8	1.16952
31.2	52.35	25.97	-225.3	-179.1	27.66	13.83	56.83	645.5	1.16676
31.4	51.44	25.52	-214.3	-167.3	28.03	13.95	61.62	624.9	1.16373
31.6	50.44	25.02	-202.3	-154.4	28.44	14.08	67.96	602.4	1.16036
31.8	49.29	24.45	-189.0	-139.9	28.90	14.24	76.94	577.6	1.15651
32.0	47.93	23.77	-173.7	-123.3	29.42	14.46	90.90	549.6	1.15197
32.1	47.13	23.38	-165.0	-113.7	29.72	14.59	101.5	533.8	1.14931
32.2	46.20	22.92	-155.2	-102.8	30.06	14.75	116.7	516.5	1.14626
32.3	45.10	22.37	-143.7	-90.0	30.45	14.94	140.9	496.9	1.14261
32.4	43.69	21.67	-129.3	-73.9	30.95	15.21	187.8	473.6	1.13792
32.476 ^b	38.89	19.29	-84.2	-22.0	32.55	16.23	1650.0	410.5	1.12216
32.476 ^b	24.18	11.99	68.8	168.8	38.42	17.46	4692.0	367.4	1.07478
35.0	12.57	6.236	260.0	452.4	46.97	14.22	48.71	431.7	1.03840
35.5	12.02	5.964	274.5	475.7	47.63	14.01	44.78	439.3	1.03670
36.0	11.55	5.729	287.9	497.3	48.24	13.84	41.81	446.5	1.03524
36.5	11.13	5.523	300.4	517.6	48.80	13.69	39.49	453.2	1.03396
37.0	10.76	5.340	312.2	536.9	49.32	13.56	37.62	459.6	1.03282

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
38.0	10.13	5.024	334.2	573.0	50.28	13.36	34.78	471.6	1.03086
39.0	9.595	4.759	354.6	606.7	51.16	13.21	32.74	482.7	1.02921
40.0	9.135	4.531	373.8	638.7	51.97	13.10	31.20	493.1	1.02780
41.0	8.733	4.332	392.2	669.2	52.72	13.01	30.00	502.9	1.02656
42.0	8.376	4.155	409.9	698.7	53.43	12.95	29.04	512.2	1.02547
43.0	8.056	3.996	427.1	727.4	54.11	12.91	28.25	521.0	1.02449
44.0	7.766	3.852	443.8	755.3	54.75	12.87	27.60	529.6	1.02360
46.0	7.258	3.600	476.1	809.4	55.95	12.83	26.58	545.8	1.02204
48.0	6.826	3.386	507.4	861.8	57.07	12.82	25.83	560.9	1.02072
50.0	6.452	3.200	537.9	912.9	58.11	12.83	25.27	575.2	1.01958
52.0	6.123	3.037	567.9	962.9	59.09	12.87	24.84	588.7	1.01857
54.0	5.832	2.893	597.5	1012.0	60.02	12.92	24.51	601.5	1.01768
56.0	5.570	2.763	626.8	1061.0	60.91	12.99	24.27	613.6	1.01689
58.0	5.334	2.646	655.9	1109.0	61.76	13.09	24.09	625.1	1.01617
60.0	5.120	2.540	685.0	1157.0	62.57	13.20	23.98	635.9	1.01551
62.0	4.924	2.442	714.0	1205.0	63.36	13.34	23.91	646.3	1.01492
64.0	4.744	2.353	743.2	1253.0	64.12	13.50	23.90	656.1	1.01437
66.0	4.578	2.271	772.5	1301.0	64.85	13.68	23.92	665.4	1.01386
68.0	4.424	2.194	802.0	1349.0	65.57	13.87	23.98	674.3	1.01339
70.0	4.281	2.124	831.8	1397.0	66.26	14.09	24.07	682.7	1.01296
75.0	3.964	1.966	907.8	1518.0	67.94	14.71	24.43	702.3	1.01200
80.0	3.694	1.832	986.5	1641.0	69.53	15.42	24.94	720.0	1.01117
85.0	3.460	1.716	1069.0	1768.0	71.06	16.20	25.57	736.4	1.01046
90.0	3.255	1.615	1154.0	1897.0	72.54	17.04	26.27	751.8	1.00984
95.0	3.075	1.525	1244.0	2031.0	73.98	17.90	27.03	766.5	1.00930
100.0	2.914	1.445	1337.0	2168.0	75.39	18.77	27.80	780.8	1.00881
105.0	2.770	1.374	1435.0	2309.0	76.76	19.63	28.58	794.8	1.00837
110.0	2.640	1.309	1537.0	2453.0	78.11	20.45	29.33	808.7	1.00798
115.0	2.522	1.251	1643.0	2602.0	79.43	21.21	30.04	822.6	1.00762
120.0	2.414	1.197	1752.0	2754.0	80.72	21.91	30.69	836.5	1.00729
125.0	2.315	1.149	1864.0	2909.0	81.99	22.52	31.26	850.5	1.00699
130.0	2.225	1.104	1979.0	3066.0	83.22	23.05	31.75	864.7	1.00672
140.0	2.064	1.024	2216.0	3388.0	85.60	23.89	32.53	893.0	1.00623
150.0	1.925	.9548	2459.0	3716.0	87.87	24.41	33.00	921.6	1.00581
160.0	1.804	.8947	2706.0	4047.0	90.00	24.67	33.22	950.4	1.00545
170.0	1.697	.8419	2954.0	4379.0	92.02	24.72	33.24	979.1	1.00512
180.0	1.603	.7950	3202.0	4711.0	93.92	24.62	33.10	1008.0	1.00484
190.0	1.518	.7531	3448.0	5041.0	95.70	24.40	32.86	1036.0	1.00458
200.0	1.442	.7155	3691.0	5368.0	97.38	24.12	32.57	1064.0	1.00435
210.0	1.374	.6814	3931.0	5692.0	98.96	23.81	32.24	1092.0	1.00415
220.0	1.311	.6505	4168.0	6013.0	100.5	23.49	31.90	1120.0	1.00396
230.0	1.255	.6223	4402.0	6330.0	101.9	23.17	31.57	1146.0	1.00379
240.0	1.202	.5965	4633.0	6644.0	103.2	22.87	31.27	1173.0	1.00363
250.0	1.155	.5727	4860.0	6956.0	104.5	22.60	30.98	1199.0	1.00348
260.0	1.110	.5508	5085.0	7264.0	105.7	22.35	30.73	1224.0	1.00335
270.0	1.069	.5304	5308.0	7570.0	106.8	22.13	30.50	1248.0	1.00323
280.0	1.031	.5116	5529.0	7874.0	107.9	21.94	30.31	1273.0	1.00311
300.0	.9629	.4776	5965.0	8477.0	110.0	21.64	29.99	1319.0	1.00291
320.0	.9030	.4479	6396.0	9075.0	111.9	21.42	29.76	1364.0	1.00272
340.0	.8501	.4217	6823.0	9668.0	113.7	21.26	29.60	1406.0	1.00256
360.0	.8031	.3984	7247.0	10260.0	115.4	21.16	29.49	1448.0	1.00242
380.0	.7611	.3775	7670.0	10850.0	117.0	21.09	29.42	1488.0	1.00230
400.0	.7232	.3587	8091.0	11440.0	118.5	21.03	29.36	1526.0	1.00218

1.29 MPa isobar

14.23 ^a	77.65	38.52	-620.9	-587.4	10.11	10.93	14.62	1338.0	1.25381
15.0	77.06	38.22	-610.1	-576.4	10.87	10.17	14.06	1315.0	1.25171
16.0	76.26	37.83	-596.3	-562.2	11.78	10.01	14.28	1284.0	1.24891
18.0	74.54	36.98	-567.0	-532.1	13.55	10.62	15.97	1225.0	1.24288
20.0	72.62	36.02	-533.9	-498.1	15.34	11.38	18.15	1168.0	1.23616
22.0	70.45	34.95	-496.3	-459.4	17.18	11.97	20.51	1110.0	1.22862
24.0	67.98	33.72	-454.1	-415.8	19.08	12.39	23.18	1045.0	1.22004

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol-K)	C _v J/(mol-K)	C _p J/(mol-K)	Sound m/s	Diel. const.
25.0	66.60	33.03	-430.9	-391.9	20.06	12.55	24.74	1010.0	1.21526
26.0	65.09	32.29	-406.2	-366.3	21.06	12.70	26.53	970.6	1.21008
27.0	63.44	31.47	-379.7	-338.7	22.10	12.84	28.67	927.8	1.20439
28.0	61.59	30.55	-351.0	-308.7	23.19	12.98	31.35	880.1	1.19807
29.0	59.48	29.51	-319.4	-275.7	24.35	13.14	34.93	826.1	1.19089
29.5	58.30	28.92	-302.3	-257.7	24.96	13.23	37.28	796.2	1.18687
30.0	57.00	28.28	-283.9	-238.3	25.61	13.34	40.21	763.7	1.18246
30.5	55.56	27.56	-264.1	-217.3	26.31	13.47	44.04	728.2	1.17757
31.0	53.90	26.74	-242.3	-194.0	27.07	13.63	49.37	688.5	1.17199
31.2	53.17	26.37	-232.8	-183.9	27.39	13.71	52.17	671.3	1.16951
31.4	52.37	25.98	-222.8	-173.1	27.74	13.80	55.56	653.0	1.16684
31.6	51.51	25.55	-212.1	-161.6	28.10	13.90	59.76	633.5	1.16394
31.8	50.56	25.08	-200.6	-149.2	28.49	14.02	65.16	612.5	1.16075
32.0	49.49	24.55	-188.0	-135.4	28.92	14.17	72.42	589.8	1.15718
32.2	48.26	23.94	-173.9	-120.0	29.41	14.34	82.86	564.6	1.15307
32.3	47.56	23.59	-166.0	-111.3	29.67	14.45	90.08	550.9	1.15074
32.4	46.78	23.21	-157.5	-101.9	29.97	14.57	99.48	536.2	1.14817
32.5	45.90	22.77	-148.0	-91.3	30.29	14.72	112.4	520.3	1.14525
32.6	44.88	22.26	-137.2	-79.2	30.66	14.89	131.3	502.8	1.14187
32.7	43.64	21.65	-124.3	-64.7	31.11	15.12	162.3	483.0	1.13775
32.8	41.99	20.83	-107.7	-45.8	31.69	15.42	224.7	459.6	1.13234
32.9	39.35	19.52	-81.7	-15.6	32.61	15.92	434.1	428.7	1.12365
33.0	25.86	12.83	58.1	158.6	37.89	17.22	1038.0	377.1	1.08011
33.1	22.58	11.20	99.0	214.2	39.57	16.86	353.1	381.1	1.06971
33.2	21.09	10.46	119.4	242.7	40.43	16.58	235.2	384.9	1.06501
33.3	20.09	9.964	133.8	263.3	41.05	16.35	182.9	388.3	1.06185
33.4	19.32	9.585	145.4	280.0	41.55	16.16	152.7	391.4	1.05945
33.5	18.70	9.276	155.1	294.2	41.98	15.99	132.7	394.3	1.05750
33.6	18.17	9.016	163.6	306.7	42.35	15.84	118.4	397.1	1.05585
33.7	17.72	8.790	171.2	318.0	42.68	15.70	107.6	399.7	1.05442
33.8	17.32	8.590	178.1	328.3	42.99	15.58	99.15	402.2	1.05316
34.0	16.63	8.248	190.4	346.8	43.54	15.35	86.61	406.8	1.05101
34.2	16.05	7.962	201.1	363.2	44.02	15.16	77.73	411.2	1.04921
34.4	15.55	7.716	210.8	378.0	44.45	14.98	71.06	415.3	1.04766
34.6	15.12	7.499	219.7	391.7	44.85	14.83	65.85	419.1	1.04630
34.8	14.73	7.306	227.9	404.4	45.21	14.69	61.66	422.9	1.04509
35.0	14.38	7.131	235.5	416.4	45.56	14.57	58.20	426.4	1.04400
35.5	13.62	6.757	252.9	443.8	46.33	14.30	51.71	434.7	1.04166
36.0	13.00	6.448	268.4	468.4	47.02	14.08	47.15	442.4	1.03972
36.5	12.47	6.183	282.5	491.1	47.65	13.89	43.75	449.6	1.03807
37.0	12.00	5.953	295.6	512.3	48.22	13.74	41.12	456.4	1.03663
37.5	11.59	5.749	307.9	532.3	48.76	13.61	39.02	462.8	1.03536
38.0	11.22	5.566	319.6	551.4	49.27	13.49	37.31	469.0	1.03422
38.5	10.89	5.400	330.8	569.7	49.75	13.40	35.87	474.8	1.03319
39.0	10.58	5.248	341.5	587.3	50.20	13.31	34.66	480.5	1.03225
40.0	10.04	4.980	361.9	620.9	51.05	13.18	32.72	491.2	1.03058
41.0	9.571	4.748	381.2	652.9	51.84	13.08	31.25	501.3	1.02914
42.0	9.159	4.543	399.6	683.5	52.58	13.01	30.09	510.8	1.02787
43.0	8.793	4.362	417.4	713.1	53.28	12.95	29.15	519.9	1.02675
44.0	8.463	4.198	434.6	741.9	53.94	12.91	28.38	528.6	1.02574
45.0	8.164	4.050	451.4	769.9	54.57	12.88	27.73	537.0	1.02482
46.0	7.891	3.914	467.8	797.4	55.17	12.86	27.19	545.1	1.02398
48.0	7.408	3.675	499.8	850.9	56.31	12.84	26.33	560.5	1.02250
50.0	6.992	3.468	530.9	902.8	57.37	12.85	25.68	575.0	1.02123
52.0	6.628	3.288	561.3	953.7	58.37	12.88	25.19	588.6	1.02011
54.0	6.306	3.128	591.3	1004.0	59.31	12.93	24.82	601.5	1.01913
56.0	6.019	2.986	620.9	1053.0	60.21	13.00	24.53	613.7	1.01825
58.0	5.760	2.857	650.4	1102.0	61.06	13.10	24.33	625.3	1.01746
60.0	5.525	2.741	679.7	1150.0	61.89	13.21	24.19	636.2	1.01675
62.0	5.311	2.635	709.0	1199.0	62.68	13.35	24.11	646.6	1.01610
64.0	5.115	2.537	738.4	1247.0	63.44	13.51	24.07	656.5	1.01550
66.0	4.934	2.448	767.9	1295.0	64.18	13.69	24.08	665.8	1.01495
68.0	4.767	2.365	797.6	1343.0	64.90	13.88	24.13	674.8	1.01444

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
70.0	4.612	2.288	827.6	1392.0	65.60	14.10	24.21	683.2	1.01396
72.0	4.467	2.216	857.9	1440.0	66.29	14.33	24.33	691.4	1.01352
74.0	4.332	2.149	888.5	1489.0	66.96	14.59	24.47	699.1	1.01311
76.0	4.205	2.086	919.5	1538.0	67.61	14.85	24.64	706.6	1.01273
80.0	3.975	1.972	983.0	1637.0	68.88	15.43	25.04	720.7	1.01203
85.0	3.722	1.846	1065.0	1764.0	70.42	16.21	25.65	737.1	1.01126
90.0	3.501	1.737	1151.0	1894.0	71.91	17.05	26.35	752.5	1.01059
95.0	3.306	1.640	1241.0	2028.0	73.35	17.91	27.09	767.2	1.01000
100.0	3.133	1.554	1335.0	2165.0	74.76	18.78	27.86	781.5	1.00947
105.0	2.977	1.477	1433.0	2306.0	76.14	19.63	28.63	795.5	1.00900
110.0	2.837	1.407	1535.0	2451.0	77.49	20.45	29.38	809.5	1.00858
115.0	2.710	1.344	1640.0	2600.0	78.81	21.22	30.09	823.3	1.00819
120.0	2.594	1.287	1750.0	2752.0	80.10	21.91	30.73	837.3	1.00784
125.0	2.488	1.234	1862.0	2907.0	81.37	22.53	31.30	851.3	1.00752
130.0	2.391	1.186	1977.0	3065.0	82.61	23.06	31.79	865.5	1.00722
135.0	2.301	1.141	2094.0	3225.0	83.81	23.51	32.20	879.7	1.00695
140.0	2.217	1.100	2214.0	3387.0	84.99	23.89	32.56	893.8	1.00670
150.0	2.068	1.026	2457.0	3715.0	87.26	24.42	33.02	922.5	1.00625
160.0	1.938	.9612	2704.0	4046.0	89.39	24.68	33.24	951.2	1.00585
170.0	1.823	.9044	2953.0	4379.0	91.41	24.73	33.26	980.0	1.00551
180.0	1.722	.8541	3201.0	4711.0	93.31	24.62	33.12	1009.0	1.00520
190.0	1.631	.8091	3447.0	5041.0	95.09	24.40	32.88	1037.0	1.00492
200.0	1.550	.7686	3690.0	5368.0	96.77	24.12	32.58	1065.0	1.00468
210.0	1.476	.7321	3930.0	5692.0	98.35	23.81	32.25	1093.0	1.00445
220.0	1.409	.6989	4167.0	6013.0	99.85	23.49	31.91	1120.0	1.00425
230.0	1.348	.6686	4401.0	6331.0	101.3	23.17	31.58	1147.0	1.00407
240.0	1.292	.6408	4632.0	6645.0	102.6	22.88	31.28	1174.0	1.00390
250.0	1.240	.6153	4860.0	6956.0	103.9	22.60	30.99	1199.0	1.00374
260.0	1.193	.5917	5085.0	7265.0	105.1	22.36	30.74	1225.0	1.00360
270.0	1.149	.5699	5308.0	7571.0	106.2	22.14	30.51	1249.0	1.00347
280.0	1.108	.5496	5528.0	7875.0	107.3	21.94	30.31	1273.0	1.00334
300.0	1.035	.5132	5964.0	8478.0	109.4	21.64	30.00	1320.0	1.00312
320.0	.9702	.4813	6395.0	9076.0	111.3	21.42	29.77	1364.0	1.00293
340.0	.9134	.4531	6822.0	9669.0	113.1	21.27	29.61	1407.0	1.00276
360.0	.8630	.4281	7247.0	10260.0	114.8	21.16	29.50	1448.0	1.00260
380.0	.8178	.4057	7669.0	10850.0	116.4	21.09	29.42	1488.0	1.00247
400.0	.7771	.3855	8091.0	11440.0	117.9	21.03	29.36	1527.0	1.00234

1.30 MPa isobar

14.23*	77.66	38.52	-620.8	-587.1	10.12	10.93	14.61	1338.0	1.25383
15.0	77.07	38.23	-610.1	-576.1	10.87	10.18	14.06	1315.0	1.25174
16.0	76.27	37.83	-596.4	-562.0	11.78	10.01	14.28	1285.0	1.24894
18.0	74.55	36.98	-567.1	-531.9	13.55	10.62	15.97	1225.0	1.24291
20.0	72.63	36.03	-533.9	-497.9	15.34	11.38	18.14	1168.0	1.23620
22.0	70.47	34.95	-496.4	-459.3	17.18	11.96	20.50	1110.0	1.22867
24.0	68.00	33.73	-454.2	-415.7	19.07	12.39	23.17	1046.0	1.22010
25.0	66.62	33.04	-431.1	-391.7	20.05	12.55	24.72	1010.0	1.21533
26.0	65.11	32.30	-406.4	-366.1	21.05	12.70	26.50	971.5	1.21015
27.0	63.46	31.48	-379.9	-338.6	22.09	12.84	28.63	928.8	1.20448
28.0	61.62	30.57	-351.2	-308.7	23.18	12.98	31.29	881.3	1.19818
29.0	59.52	29.53	-319.8	-275.7	24.34	13.13	34.85	827.6	1.19102
29.5	58.35	28.94	-302.7	-257.8	24.95	13.23	37.16	797.8	1.18702
30.0	57.06	28.30	-284.4	-238.5	25.60	13.33	40.05	765.6	1.18264
30.5	55.62	27.59	-264.7	-217.6	26.29	13.46	43.81	730.3	1.17777
31.0	53.98	26.78	-243.0	-194.4	27.04	13.62	49.02	691.0	1.17225
31.5	52.05	25.82	-218.5	-168.1	27.88	13.83	56.93	646.4	1.16576
31.7	51.16	25.38	-207.5	-156.3	28.26	13.94	61.47	626.5	1.16277
31.8	50.68	25.14	-201.7	-150.0	28.46	14.00	64.22	616.0	1.16116
32.0	49.63	24.62	-189.3	-136.5	28.88	14.14	71.07	593.7	1.15766
32.2	48.43	24.03	-175.5	-121.4	29.35	14.31	80.78	569.1	1.15367

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
32.4	47.01	23.32	-159.6	-103.8	29.89	14.53	95.84	541.5	1.14893
32.5	46.17	22.90	-150.5	-93.7	30.20	14.66	107.2	526.2	1.14616
32.6	45.21	22.43	-140.2	-82.3	30.56	14.83	123.2	509.4	1.14297
32.7	44.07	21.86	-128.3	-68.8	30.97	15.03	148.2	490.8	1.13919
32.8	42.62	21.14	-113.5	-52.0	31.48	15.29	193.3	469.3	1.13441
32.9	40.54	20.11	-92.8	-28.1	32.21	15.68	303.9	442.8	1.12758
33.0	35.84	17.78	-46.9	26.3	33.86	16.52	1251.0	401.9	1.11222
33.1	24.36	12.08	77.4	185.0	38.66	17.05	550.1	379.6	1.07534
33.2	22.16	10.99	105.9	224.2	39.85	16.74	295.1	383.4	1.06838
33.3	20.89	10.36	123.6	249.1	40.59	16.49	213.2	386.9	1.06437
33.4	19.97	9.908	136.9	268.1	41.17	16.28	171.4	390.2	1.06150
33.5	19.26	9.553	147.8	283.9	41.64	16.10	145.6	393.2	1.05925
33.6	18.67	9.260	157.1	297.5	42.04	15.94	128.0	396.0	1.05739
33.7	18.16	9.010	165.3	309.6	42.40	15.79	115.0	398.7	1.05581
33.8	17.72	8.791	172.7	320.6	42.73	15.66	105.1	401.2	1.05443
34.0	16.98	8.421	185.7	340.1	43.30	15.42	90.74	406.0	1.05210
34.2	16.36	8.115	197.0	357.2	43.81	15.22	80.79	410.4	1.05017
34.4	15.83	7.854	207.1	372.6	44.25	15.04	73.44	414.5	1.04853
34.6	15.37	7.626	216.2	386.7	44.66	14.88	67.77	418.5	1.04710
34.8	14.97	7.424	224.7	399.8	45.04	14.74	63.25	422.2	1.04583
35.0	14.60	7.242	232.5	412.0	45.39	14.61	59.54	425.8	1.04469
35.2	14.27	7.076	239.9	423.6	45.72	14.49	56.44	429.3	1.04365
35.5	13.82	6.853	250.3	440.0	46.18	14.33	52.64	434.2	1.04225
36.0	13.17	6.533	266.0	465.0	46.88	14.11	47.84	442.0	1.04025
36.5	12.62	6.261	280.4	488.0	47.52	13.92	44.30	449.2	1.03855
37.0	12.15	6.025	293.7	509.5	48.10	13.76	41.56	456.0	1.03708
37.5	11.72	5.815	306.1	529.7	48.65	13.63	39.39	462.5	1.03578
38.0	11.35	5.628	317.9	548.9	49.15	13.51	37.61	468.7	1.03461
38.5	11.00	5.459	329.2	567.3	49.64	13.41	36.14	474.6	1.03356
39.0	10.69	5.304	340.0	585.1	50.09	13.32	34.89	480.3	1.03260
40.0	10.14	5.031	360.5	618.9	50.95	13.19	32.91	491.0	1.03090
41.0	9.666	4.795	379.9	651.1	51.74	13.09	31.40	501.1	1.02943
42.0	9.248	4.587	398.5	681.8	52.49	13.01	30.21	510.7	1.02815
43.0	8.876	4.403	416.3	711.6	53.19	12.96	29.25	519.8	1.02700
44.0	8.542	4.237	433.6	740.4	53.85	12.92	28.47	528.5	1.02598
45.0	8.239	4.087	450.4	768.5	54.48	12.89	27.81	536.9	1.02505
46.0	7.962	3.950	466.9	796.1	55.09	12.86	27.26	545.0	1.02420
48.0	7.473	3.707	499.0	849.7	56.23	12.85	26.38	560.4	1.02270
50.0	7.052	3.498	530.1	901.7	57.29	12.85	25.73	574.9	1.02141
52.0	6.685	3.316	560.6	952.7	58.29	12.88	25.23	588.6	1.02029
54.0	6.359	3.155	590.6	1003.0	59.23	12.93	24.85	601.5	1.01929
56.0	6.069	3.010	620.3	1052.0	60.13	13.01	24.56	613.7	1.01841
58.0	5.808	2.881	649.8	1101.0	60.99	13.10	24.36	625.3	1.01761
60.0	5.571	2.763	679.1	1150.0	61.81	13.21	24.21	636.3	1.01689
62.0	5.354	2.656	708.5	1198.0	62.61	13.35	24.13	646.7	1.01623
64.0	5.156	2.558	737.9	1246.0	63.37	13.51	24.09	656.5	1.01562
66.0	4.974	2.467	767.4	1294.0	64.11	13.69	24.10	665.9	1.01507
68.0	4.805	2.383	797.1	1343.0	64.83	13.88	24.14	674.8	1.01455
70.0	4.648	2.306	827.1	1391.0	65.53	14.10	24.23	683.3	1.01408
72.0	4.502	2.233	857.4	1439.0	66.22	14.33	24.34	691.4	1.01363
74.0	4.366	2.166	888.1	1488.0	66.89	14.59	24.48	699.2	1.01322
76.0	4.239	2.103	919.1	1537.0	67.54	14.85	24.65	706.6	1.01283
80.0	4.006	1.987	982.6	1637.0	68.82	15.43	25.05	720.7	1.01212
85.0	3.751	1.861	1065.0	1764.0	70.35	16.21	25.66	737.1	1.01135
90.0	3.528	1.750	1151.0	1894.0	71.84	17.05	26.35	752.5	1.01067
95.0	3.332	1.653	1241.0	2027.0	73.28	17.91	27.10	767.3	1.01008
100.0	3.157	1.566	1334.0	2165.0	74.69	18.78	27.87	781.6	1.00955
105.0	3.000	1.488	1432.0	2306.0	76.07	19.63	28.64	795.6	1.00907
110.0	2.859	1.418	1534.0	2451.0	77.42	20.45	29.39	809.5	1.00864
115.0	2.731	1.355	1640.0	2600.0	78.74	21.22	30.09	823.4	1.00825
120.0	2.614	1.297	1749.0	2752.0	80.04	21.91	30.73	837.4	1.00790
125.0	2.507	1.244	1862.0	2907.0	81.30	22.53	31.30	851.4	1.00758
130.0	2.409	1.195	1977.0	3065.0	82.54	23.06	31.79	865.5	1.00728

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
135.0	2.318	1.150	2094.0	3225.0	83.75	23.51	32.20	879.8	1.00700
140.0	2.234	1.108	2214.0	3387.0	84.93	23.90	32.56	893.9	1.00675
150.0	2.084	1.034	2457.0	3715.0	87.19	24.42	33.03	922.6	1.00629
160.0	1.953	.9686	2704.0	4046.0	89.33	24.68	33.24	951.3	1.00590
170.0	1.837	.9114	2953.0	4379.0	91.35	24.73	33.26	980.1	1.00555
180.0	1.735	.8606	3200.0	4711.0	93.24	24.62	33.12	1009.0	1.00524
190.0	1.644	.8153	3446.0	5041.0	95.03	24.40	32.88	1037.0	1.00496
200.0	1.561	.7745	3690.0	5368.0	96.71	24.12	32.58	1065.0	1.00471
210.0	1.487	.7377	3930.0	5693.0	98.29	23.81	32.25	1093.0	1.00449
220.0	1.420	.7042	4167.0	6013.0	99.78	23.49	31.91	1121.0	1.00428
230.0	1.358	.6737	4401.0	6331.0	101.2	23.17	31.58	1147.0	1.00410
240.0	1.302	.6457	4632.0	6645.0	102.5	22.88	31.28	1174.0	1.00393
250.0	1.250	.6200	4860.0	6956.0	103.8	22.60	30.99	1199.0	1.00377
260.0	1.202	.5963	5085.0	7265.0	105.0	22.36	30.74	1225.0	1.00363
270.0	1.158	.5743	5308.0	7571.0	106.2	22.14	30.51	1249.0	1.00349
280.0	1.117	.5539	5528.0	7875.0	107.3	21.95	30.31	1273.0	1.00337
300.0	1.042	.5171	5964.0	8478.0	109.4	21.64	30.00	1320.0	1.00315
320.0	.9777	.4850	6395.0	9076.0	111.3	21.42	29.77	1365.0	1.00295
340.0	.9205	.4566	6822.0	9669.0	113.1	21.27	29.61	1407.0	1.00278
360.0	.8696	.4314	7247.0	10260.0	114.8	21.16	29.50	1449.0	1.00262
380.0	.8241	.4088	7669.0	10850.0	116.4	21.09	29.42	1488.0	1.00249
400.0	.7831	.3884	8091.0	11440.0	117.9	21.03	29.36	1527.0	1.00236

1.32 MPa isobar

14.24 ^a	77.67	38.53	-620.8	-586.6	10.12	10.93	14.60	1338.0	1.25386
15.0	77.08	38.24	-610.2	-575.7	10.86	10.18	14.06	1315.0	1.25180
16.0	76.29	37.84	-596.5	-561.6	11.77	10.01	14.27	1285.0	1.24900
18.0	74.57	36.99	-567.2	-531.5	13.54	10.62	15.96	1226.0	1.24298
20.0	72.65	36.04	-534.1	-497.5	15.33	11.38	18.13	1169.0	1.23629
22.0	70.49	34.97	-496.6	-458.9	17.17	11.96	20.48	1111.0	1.22876
24.0	68.03	33.75	-454.5	-415.3	19.06	12.39	23.14	1048.0	1.22022
25.0	66.65	33.06	-431.4	-391.4	20.04	12.55	24.68	1012.0	1.21546
26.0	65.16	32.32	-406.8	-365.9	21.04	12.70	26.44	973.4	1.21031
27.0	63.51	31.51	-380.3	-338.4	22.07	12.84	28.55	930.9	1.20466
28.0	61.68	30.60	-351.8	-308.6	23.16	12.97	31.18	883.8	1.19839
29.0	59.60	29.56	-320.4	-275.8	24.31	13.13	34.67	830.6	1.19128
29.5	58.43	28.99	-303.5	-257.9	24.92	13.22	36.94	801.1	1.18732
30.0	57.16	28.35	-285.3	-238.8	25.56	13.32	39.75	769.3	1.18298
30.5	55.74	27.65	-265.8	-218.0	26.25	13.44	43.38	734.5	1.17818
31.0	54.13	26.85	-244.3	-195.2	26.99	13.60	48.35	695.9	1.17275
31.5	52.24	25.91	-220.2	-169.3	27.82	13.80	55.78	652.3	1.16641
31.7	51.38	25.49	-209.5	-157.7	28.19	13.91	59.97	633.0	1.16351
31.8	50.91	25.26	-203.9	-151.6	28.38	13.96	62.47	622.8	1.16195
32.0	49.91	24.76	-191.9	-138.5	28.79	14.09	68.63	601.2	1.15859
32.2	48.77	24.19	-178.6	-124.0	29.24	14.25	77.11	577.7	1.15479
32.4	47.44	23.53	-163.5	-107.4	29.76	14.45	89.70	551.6	1.15036
32.5	46.67	23.15	-155.0	-98.0	30.05	14.57	98.72	537.2	1.14781
32.6	45.81	22.72	-145.7	-87.6	30.37	14.71	110.9	521.7	1.14494
32.7	44.81	22.23	-135.1	-75.7	30.73	14.88	128.3	504.8	1.14164
32.8	43.62	21.64	-122.6	-61.6	31.16	15.08	155.6	486.0	1.13769
32.9	42.09	20.88	-107.0	-43.8	31.70	15.36	205.8	464.3	1.13266
33.0	39.86	19.77	-84.9	-18.1	32.48	15.77	332.2	437.7	1.12534
33.1	34.82	17.27	-35.3	41.1	34.27	16.63	1227.0	398.8	1.10892
33.2	25.57	12.68	64.9	168.9	38.13	17.07	630.9	381.2	1.07918
33.3	23.00	11.41	97.3	213.0	39.46	16.79	325.0	384.4	1.07103
33.4	21.57	10.70	116.7	240.1	40.27	16.54	229.6	387.7	1.06651
33.5	20.56	10.20	131.0	260.4	40.88	16.33	182.1	390.9	1.06335
33.6	19.79	9.815	142.6	277.1	41.37	16.14	153.3	393.8	1.06090
33.7	19.15	9.499	152.4	291.4	41.80	15.98	133.9	396.6	1.05891
33.8	18.61	9.232	161.0	304.0	42.17	15.83	119.7	399.3	1.05721
33.9	18.14	8.999	168.8	315.4	42.51	15.69	109.0	401.8	1.05575
34.0	17.73	8.793	175.8	325.9	42.82	15.57	100.5	404.2	1.05445

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C, J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
34.2	17.02	8.441	188.3	344.7	43.37	15.35	87.81	408.8	1.05223
34.4	16.42	8.146	199.2	361.3	43.85	15.16	78.79	413.1	1.05037
34.6	15.91	7.892	209.1	376.3	44.29	14.99	72.01	417.1	1.04877
34.8	15.46	7.669	218.0	390.2	44.69	14.83	66.71	421.0	1.04737
35.0	15.06	7.470	226.4	403.1	45.06	14.69	62.43	424.6	1.04612
35.2	14.70	7.290	234.1	415.2	45.40	14.57	58.91	428.2	1.04499
35.5	14.21	7.050	245.0	432.2	45.88	14.40	54.63	433.2	1.04349
36.0	13.52	6.708	261.3	458.1	46.61	14.16	49.31	441.1	1.04135
36.5	12.94	6.419	276.1	481.7	47.26	13.97	45.44	448.4	1.03954
37.0	12.44	6.170	289.8	503.7	47.86	13.80	42.48	455.3	1.03799
37.5	12.00	5.951	302.5	524.3	48.41	13.66	40.14	461.9	1.03662
38.0	11.60	5.755	314.5	543.9	48.93	13.54	38.25	468.1	1.03540
38.5	11.25	5.578	326.0	562.6	49.42	13.44	36.68	474.1	1.03430
39.0	10.92	5.418	337.0	580.6	49.88	13.35	35.37	479.8	1.03330
40.0	10.35	5.134	357.8	614.9	50.75	13.21	33.28	490.7	1.03154
41.0	9.858	4.890	377.4	647.4	51.55	13.11	31.69	500.8	1.03002
42.0	9.427	4.676	396.1	678.4	52.30	13.03	30.46	510.4	1.02870
43.0	9.044	4.486	414.1	708.3	53.01	12.97	29.46	519.6	1.02752
44.0	8.700	4.316	431.5	737.4	53.67	12.93	28.65	528.3	1.02646
45.0	8.389	4.161	448.5	765.7	54.31	12.89	27.97	536.8	1.02551
46.0	8.105	4.021	465.1	793.4	54.92	12.87	27.40	544.9	1.02464
48.0	7.604	3.772	497.3	847.2	56.06	12.85	26.50	560.4	1.02310
50.0	7.174	3.558	528.5	899.5	57.13	12.86	25.82	574.9	1.02178
52.0	6.798	3.372	559.1	950.6	58.13	12.88	25.31	588.6	1.02063
54.0	6.466	3.207	589.2	1001.0	59.08	12.94	24.92	601.5	1.01962
56.0	6.169	3.060	619.0	1050.0	59.98	13.01	24.62	613.8	1.01871
58.0	5.903	2.928	648.5	1099.0	60.84	13.10	24.41	625.4	1.01790
60.0	5.661	2.808	678.0	1148.0	61.67	13.22	24.26	636.3	1.01716
62.0	5.441	2.699	707.4	1196.0	62.46	13.35	24.17	646.7	1.01649
64.0	5.239	2.599	736.8	1245.0	63.23	13.51	24.13	656.6	1.01588
66.0	5.053	2.507	766.4	1293.0	63.97	13.69	24.13	666.0	1.01531
68.0	4.881	2.421	796.2	1341.0	64.69	13.89	24.18	674.9	1.01479
70.0	4.722	2.342	826.2	1390.0	65.39	14.10	24.26	683.4	1.01430
72.0	4.573	2.269	856.5	1438.0	66.08	14.34	24.37	691.5	1.01385
74.0	4.435	2.200	887.2	1487.0	66.75	14.59	24.51	699.3	1.01343
76.0	4.305	2.135	918.3	1536.0	67.40	14.85	24.67	706.8	1.01303
80.0	4.069	2.018	981.8	1636.0	68.68	15.43	25.08	720.9	1.01231
85.0	3.809	1.890	1064.0	1763.0	70.22	16.21	25.68	737.3	1.01153
90.0	3.583	1.777	1150.0	1893.0	71.70	17.05	26.37	752.7	1.01084
95.0	3.383	1.678	1240.0	2027.0	73.15	17.91	27.11	767.4	1.01023
100.0	3.206	1.590	1334.0	2164.0	74.56	18.78	27.88	781.7	1.00969
105.0	3.046	1.511	1432.0	2305.0	75.94	19.64	28.65	795.8	1.00921
110.0	2.903	1.440	1534.0	2450.0	77.29	20.45	29.40	809.7	1.00877
115.0	2.773	1.375	1640.0	2599.0	78.61	21.22	30.10	823.6	1.00838
120.0	2.654	1.317	1749.0	2751.0	79.91	21.92	30.74	837.5	1.00802
125.0	2.546	1.263	1861.0	2907.0	81.17	22.53	31.31	851.6	1.00769
130.0	2.446	1.213	1976.0	3064.0	82.41	23.06	31.80	865.7	1.00739
135.0	2.354	1.168	2094.0	3224.0	83.62	23.51	32.21	879.9	1.00711
140.0	2.268	1.125	2213.0	3386.0	84.80	23.90	32.57	894.1	1.00685
150.0	2.116	1.049	2457.0	3715.0	87.06	24.42	33.03	922.7	1.00639
160.0	1.982	.9834	2704.0	4046.0	89.20	24.68	33.25	951.5	1.00599
170.0	1.865	.9253	2952.0	4379.0	91.22	24.73	33.26	980.2	1.00563
180.0	1.761	.8737	3200.0	4711.0	93.12	24.62	33.12	1009.0	1.00532
190.0	1.669	.8277	3446.0	5041.0	94.90	24.40	32.88	1037.0	1.00504
200.0	1.585	.7863	3690.0	5368.0	96.58	24.12	32.58	1066.0	1.00479
210.0	1.510	.7489	3930.0	5693.0	98.16	23.81	32.25	1093.0	1.00456
220.0	1.441	.7150	4167.0	6013.0	99.65	23.49	31.91	1121.0	1.00435
230.0	1.379	.6840	4401.0	6331.0	101.1	23.17	31.59	1148.0	1.00416
240.0	1.322	.6556	4632.0	6645.0	102.4	22.88	31.28	1174.0	1.00399
250.0	1.269	.6295	4860.0	6957.0	103.7	22.60	30.99	1200.0	1.00383
260.0	1.220	.6054	5085.0	7265.0	104.9	22.36	30.74	1225.0	1.00368
270.0	1.175	.5830	5307.0	7571.0	106.0	22.14	30.51	1249.0	1.00355
280.0	1.134	.5623	5528.0	7876.0	107.1	21.95	30.31	1274.0	1.00342

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C, J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
300.0	1.058	.5250	5964.0	8478.0	109.2	21.64	30.00	1320.0	1.00319
320.0	.9926	.4924	6395.0	9076.0	111.2	21.42	29.77	1365.0	1.00299
340.0	.9345	.4636	6822.0	9670.0	113.0	21.27	29.61	1407.0	1.00282
360.0	.8829	.4380	7247.0	10260.0	114.6	21.16	29.50	1449.0	1.00266
380.0	.8367	.4150	7669.0	10850.0	116.2	21.09	29.42	1489.0	1.00252
400.0	.7951	.3944	8091.0	11440.0	117.7	21.03	29.36	1527.0	1.00240
1.34 MPa isobar									
14.24 ^a	77.68	38.53	-620.8	-586.0	10.12	10.93	14.59	1337.0	1.25390
15.0	77.10	38.24	-610.3	-575.2	10.86	10.19	14.05	1315.0	1.25185
16.0	76.30	37.85	-596.6	-561.2	11.77	10.02	14.26	1285.0	1.24906
18.0	74.59	37.00	-567.3	-531.1	13.53	10.62	15.95	1226.0	1.24305
20.0	72.68	36.05	-534.2	-497.1	15.32	11.38	18.12	1170.0	1.23637
22.0	70.52	34.98	-496.8	-458.5	17.16	11.96	20.46	1113.0	1.22886
24.0	68.06	33.76	-454.7	-415.0	19.05	12.38	23.10	1049.0	1.22033
25.0	66.69	33.08	-431.7	-391.2	20.02	12.55	24.63	1014.0	1.21559
26.0	65.20	32.34	-407.1	-365.7	21.02	12.70	26.39	975.2	1.21046
27.0	63.57	31.53	-380.8	-338.3	22.06	12.83	28.48	933.0	1.20483
28.0	61.74	30.63	-352.3	-308.6	23.14	12.97	31.07	886.2	1.19860
29.0	59.68	29.60	-321.1	-275.9	24.28	13.12	34.50	833.5	1.19154
29.5	58.52	29.03	-304.2	-258.1	24.89	13.21	36.72	804.3	1.18761
30.0	57.26	28.40	-286.2	-239.1	25.53	13.31	39.45	772.9	1.18332
30.5	55.86	27.71	-266.9	-218.5	26.21	13.43	42.96	738.6	1.17858
31.0	54.27	26.92	-245.7	-195.9	26.95	13.58	47.72	700.7	1.17324
31.5	52.43	26.01	-221.9	-170.4	27.76	13.78	54.71	658.0	1.16703
31.7	51.59	25.59	-211.5	-159.1	28.12	13.87	58.59	639.2	1.16421
31.8	51.14	25.37	-205.9	-153.1	28.31	13.93	60.89	629.3	1.16271
32.0	50.17	24.89	-194.3	-140.4	28.71	14.05	66.46	608.4	1.15946
32.2	49.08	24.35	-181.4	-126.4	29.14	14.20	73.96	585.8	1.15583
32.4	47.83	23.73	-167.1	-110.6	29.63	14.37	84.70	560.9	1.15166
32.5	47.12	23.37	-159.1	-101.8	29.90	14.48	92.10	547.4	1.14929
32.6	46.33	22.98	-150.4	-92.1	30.20	14.61	101.7	533.0	1.14667
32.7	45.44	22.54	-140.8	-81.3	30.53	14.75	114.7	517.4	1.14371
32.8	44.41	22.03	-129.8	-69.0	30.91	14.92	133.5	500.4	1.14030
32.9	43.16	21.41	-116.9	-54.3	31.35	15.14	163.3	481.4	1.13618
33.0	41.55	20.61	-100.5	-35.5	31.92	15.43	218.5	459.7	1.13089
33.1	39.18	19.44	-76.9	-8.0	32.76	15.86	357.9	433.2	1.12312
33.2	34.17	16.95	-27.2	51.8	34.56	16.66	1038.0	398.2	1.10680
33.3	26.68	13.24	53.7	155.0	37.66	17.05	664.6	383.5	1.08274
33.4	23.82	11.82	88.9	202.3	39.08	16.81	350.2	385.7	1.07366
33.5	22.25	11.03	109.8	231.3	39.95	16.57	244.7	388.7	1.06866
33.6	21.15	10.49	125.2	252.9	40.59	16.36	192.3	391.8	1.06521
33.7	20.31	10.08	137.4	270.4	41.11	16.18	160.8	394.6	1.06256
33.8	19.63	9.739	147.8	285.4	41.56	16.01	139.6	397.4	1.06042
33.9	19.06	9.454	156.8	298.5	41.95	15.86	124.3	400.0	1.05862
34.0	18.56	9.208	164.8	310.4	42.30	15.73	112.8	402.5	1.05706
34.2	17.73	8.796	178.8	331.2	42.90	15.49	96.31	407.2	1.05447
34.4	17.05	8.460	190.8	349.2	43.43	15.28	85.09	411.6	1.05234
34.6	16.48	8.175	201.5	365.4	43.90	15.09	76.90	415.8	1.05055
34.8	15.98	7.928	211.1	380.1	44.32	14.93	70.63	419.7	1.04900
35.0	15.54	7.710	219.9	393.7	44.71	14.78	65.67	423.5	1.04762
35.2	15.15	7.514	228.1	406.4	45.08	14.65	61.63	427.1	1.04640
35.4	14.79	7.337	235.8	418.4	45.42	14.53	58.27	430.5	1.04529
36.0	13.89	6.888	256.5	451.0	46.33	14.22	50.89	440.2	1.04247
36.5	13.27	6.582	271.8	475.3	47.00	14.02	46.65	447.6	1.04056
37.0	12.74	6.319	285.8	497.8	47.61	13.85	43.44	454.6	1.03892
37.5	12.27	6.089	298.8	518.9	48.18	13.70	40.93	461.2	1.03748
38.0	11.86	5.884	311.1	538.8	48.71	13.58	38.91	467.5	1.03620
38.5	11.49	5.700	322.8	557.9	49.20	13.47	37.25	473.6	1.03506
39.0	11.15	5.533	333.9	576.1	49.68	13.37	35.86	479.4	1.03402
40.0	10.56	5.239	355.0	610.8	50.55	13.23	33.66	490.3	1.03219
41.0	10.05	4.986	374.9	643.6	51.36	13.12	32.00	500.5	1.03062

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
42.0	9.607	4.766	393.8	674.9	52.12	13.04	30.71	510.1	1.02925
43.0	9.213	4.570	411.9	705.1	52.83	12.98	29.68	519.3	1.02804
44.0	8.860	4.395	429.5	734.4	53.50	12.93	28.83	528.2	1.02695
45.0	8.540	4.236	446.5	762.8	54.14	12.90	28.13	536.6	1.02597
46.0	8.249	4.092	463.2	790.7	54.75	12.88	27.54	544.8	1.02508
48.0	7.736	3.837	495.6	844.8	55.90	12.85	26.61	560.3	1.02351
50.0	7.295	3.619	527.0	897.3	56.98	12.86	25.91	574.9	1.02216
52.0	6.911	3.428	557.7	948.5	57.98	12.89	25.39	588.6	1.02098
54.0	6.572	3.260	587.9	998.9	58.93	12.94	24.99	601.5	1.01994
56.0	6.270	3.110	617.7	1049.0	59.83	13.01	24.68	613.8	1.01902
58.0	5.998	2.975	647.3	1098.0	60.70	13.10	24.46	625.4	1.01819
60.0	5.752	2.853	676.8	1146.0	61.52	13.22	24.31	636.4	1.01744
62.0	5.528	2.742	706.3	1195.0	62.32	13.35	24.21	646.8	1.01676
64.0	5.322	2.640	735.8	1243.0	63.09	13.51	24.17	656.7	1.01613
66.0	5.133	2.546	765.4	1292.0	63.83	13.69	24.17	666.1	1.01555
68.0	4.958	2.459	795.2	1340.0	64.55	13.89	24.21	675.0	1.01502
70.0	4.796	2.379	825.2	1389.0	65.26	14.10	24.29	683.6	1.01453
72.0	4.645	2.304	855.6	1437.0	65.94	14.34	24.40	691.7	1.01407
74.0	4.504	2.234	886.3	1486.0	66.61	14.59	24.53	699.5	1.01364
76.0	4.372	2.168	917.4	1535.0	67.27	14.86	24.70	706.9	1.01323
80.0	4.131	2.049	981.0	1635.0	68.54	15.43	25.10	721.0	1.01250
85.0	3.868	1.918	1063.0	1762.0	70.08	16.22	25.70	737.4	1.01170
90.0	3.637	1.804	1149.0	1892.0	71.57	17.05	26.39	752.9	1.01100
95.0	3.435	1.704	1239.0	2026.0	73.02	17.91	27.13	767.6	1.01039
100.0	3.254	1.614	1333.0	2163.0	74.43	18.78	27.90	781.9	1.00984
105.0	3.092	1.534	1431.0	2305.0	75.81	19.64	28.66	796.0	1.00935
110.0	2.947	1.462	1533.0	2450.0	77.16	20.46	29.41	809.9	1.00891
115.0	2.815	1.396	1639.0	2599.0	78.48	21.22	30.11	823.8	1.00851
120.0	2.694	1.336	1748.0	2751.0	79.78	21.92	30.75	837.7	1.00814
125.0	2.584	1.282	1861.0	2906.0	81.04	22.53	31.32	851.8	1.00781
130.0	2.483	1.231	1976.0	3064.0	82.28	23.06	31.80	865.9	1.00750
135.0	2.389	1.185	2093.0	3224.0	83.49	23.51	32.22	880.1	1.00722
140.0	2.303	1.142	2213.0	3386.0	84.67	23.90	32.57	894.3	1.00696
150.0	2.147	1.065	2456.0	3714.0	86.93	24.42	33.04	922.9	1.00649
160.0	2.012	.9982	2704.0	4046.0	89.07	24.68	33.25	951.7	1.00608
170.0	1.893	.9392	2952.0	4379.0	91.09	24.73	33.27	980.4	1.00572
180.0	1.788	.8868	3200.0	4711.0	92.99	24.62	33.13	1009.0	1.00540
190.0	1.694	.8401	3446.0	5041.0	94.77	24.41	32.89	1038.0	1.00511
200.0	1.609	.7981	3689.0	5368.0	96.45	24.13	32.59	1066.0	1.00486
210.0	1.532	.7602	3930.0	5693.0	98.04	23.81	32.25	1094.0	1.00463
220.0	1.463	.7257	4167.0	6013.0	99.53	23.49	31.92	1121.0	1.00442
230.0	1.400	.6942	4401.0	6331.0	100.9	23.18	31.59	1148.0	1.00422
240.0	1.341	.6654	4632.0	6645.0	102.3	22.88	31.28	1174.0	1.00405
250.0	1.288	.6389	4859.0	6957.0	103.5	22.60	31.00	1200.0	1.00389
260.0	1.239	.6144	5085.0	7265.0	104.8	22.36	30.74	1225.0	1.00374
270.0	1.193	.5918	5307.0	7572.0	105.9	22.14	30.51	1250.0	1.00360
280.0	1.151	.5708	5528.0	7876.0	107.0	21.95	30.32	1274.0	1.00347
300.0	1.074	.5329	5964.0	8479.0	109.1	21.64	30.00	1320.0	1.00324
320.0	1.008	.4998	6395.0	9076.0	111.0	21.42	29.77	1365.0	1.00304
340.0	.9486	.4705	6822.0	9670.0	112.8	21.27	29.61	1408.0	1.00286
360.0	.8962	.4445	7247.0	10260.0	114.5	21.16	29.50	1449.0	1.00270
380.0	.8493	.4213	7669.0	10850.0	116.1	21.09	29.42	1489.0	1.00256
400.0	.8070	.4003	8091.0	11440.0	117.6	21.03	29.36	1527.0	1.00243

1.36 MPa isobar

14.25*	77.69	38.54	-620.8	-585.5	10.12	10.92	14.58	1337.0	1.25393
15.0	77.11	38.25	-610.4	-574.8	10.85	10.19	14.05	1315.0	1.25191
16.0	76.32	37.86	-596.6	-560.7	11.76	10.02	14.26	1285.0	1.24912
18.0	74.61	37.01	-567.4	-530.7	13.53	10.62	15.94	1227.0	1.24312
20.0	72.70	36.06	-534.4	-496.7	15.32	11.38	18.10	1171.0	1.23645
22.0	70.55	35.00	-497.0	-458.1	17.15	11.96	20.44	1114.0	1.22895
24.0	68.10	33.78	-455.0	-414.7	19.04	12.38	23.07	1050.0	1.22045

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
25.0	66.73	33.10	-432.0	-390.9	20.01	12.55	24.59	1015.0	1.21572
26.0	65.24	32.36	-407.5	-365.4	21.01	12.69	26.34	977.0	1.21061
27.0	63.62	31.56	-381.2	-338.1	22.04	12.83	28.40	935.1	1.20501
28.0	61.80	30.66	-352.8	-308.5	23.12	12.97	30.97	888.6	1.19881
29.0	59.75	29.64	-321.8	-275.9	24.26	13.11	34.34	836.4	1.19180
29.5	58.61	29.07	-305.0	-258.2	24.86	13.20	36.50	807.5	1.18790
30.0	57.36	28.45	-287.1	-239.3	25.50	13.30	39.16	776.4	1.18366
30.5	55.97	27.77	-267.9	-218.9	26.17	13.42	42.56	742.6	1.17898
31.0	54.42	26.99	-247.0	-196.6	26.90	13.56	47.12	705.3	1.17372
31.5	52.61	26.10	-223.6	-171.5	27.70	13.75	53.72	663.6	1.16764
31.7	51.79	25.69	-213.3	-160.4	28.05	13.84	57.33	645.2	1.16489
31.8	51.36	25.47	-207.9	-154.5	28.24	13.89	59.45	635.6	1.16343
32.0	50.42	25.01	-196.5	-142.2	28.63	14.01	64.53	615.4	1.16030
32.2	49.38	24.49	-184.2	-128.6	29.05	14.14	71.22	593.6	1.15681
32.4	48.19	23.90	-170.4	-113.5	29.52	14.31	80.53	569.8	1.15286
32.6	46.79	23.21	-154.7	-96.1	30.05	14.52	94.56	543.3	1.14821
32.7	45.98	22.81	-145.8	-86.2	30.36	14.64	104.7	528.8	1.14552
32.8	45.06	22.35	-135.9	-75.0	30.70	14.79	118.6	513.2	1.14247
32.9	43.99	21.82	-124.6	-62.2	31.09	14.97	138.8	496.1	1.13894
33.0	42.70	21.18	-111.1	-46.9	31.55	15.20	171.0	477.1	1.13466
33.1	41.01	20.34	-94.0	-27.2	32.15	15.50	230.9	455.4	1.12912
33.2	38.52	19.11	-69.2	2.0	33.03	15.94	377.5	429.5	1.12097
33.3	33.76	16.75	-21.5	59.7	34.76	16.66	854.9	398.9	1.10548
33.4	27.62	13.70	44.9	144.1	37.29	17.00	645.5	386.2	1.08572
33.5	24.62	12.21	81.0	192.4	38.74	16.82	367.1	387.3	1.07618
33.6	22.91	11.37	103.3	222.9	39.65	16.60	257.4	390.0	1.07077
33.7	21.74	10.78	119.5	245.6	40.32	16.39	201.5	392.8	1.06705
33.8	20.84	10.34	132.4	263.9	40.86	16.21	167.7	395.6	1.06422
33.9	20.11	9.978	143.2	279.5	41.32	16.04	145.0	398.3	1.06194
34.0	19.51	9.676	152.6	293.1	41.73	15.89	128.7	400.8	1.06003
34.1	18.98	9.416	160.9	305.4	42.09	15.76	116.4	403.3	1.05838
34.2	18.52	9.188	168.5	316.5	42.41	15.63	106.8	405.7	1.05694
34.4	17.74	8.800	181.8	336.4	42.99	15.41	92.57	410.2	1.05449
34.6	17.09	8.478	193.4	353.8	43.50	15.21	82.56	414.5	1.05246
34.8	16.54	8.202	203.8	369.6	43.95	15.03	75.09	418.5	1.05072
35.0	16.05	7.962	213.2	384.0	44.36	14.88	69.29	422.3	1.04921
35.2	15.62	7.748	221.8	397.4	44.74	14.74	64.65	426.0	1.04787
35.4	15.23	7.556	229.9	409.9	45.10	14.61	60.83	429.5	1.04666
35.6	14.88	7.382	237.5	421.7	45.43	14.49	57.64	432.9	1.04557
36.0	14.26	7.074	251.5	443.7	46.05	14.29	52.58	439.3	1.04364
36.5	13.61	6.749	267.3	468.8	46.74	14.07	47.93	446.9	1.04160
37.0	13.05	6.471	281.7	491.8	47.37	13.89	44.46	453.9	1.03987
37.5	12.56	6.230	295.1	513.4	47.94	13.74	41.76	460.6	1.03836
38.0	12.13	6.015	307.6	533.7	48.48	13.61	39.60	467.0	1.03702
38.5	11.74	5.823	319.5	553.0	48.99	13.50	37.84	473.1	1.03582
39.0	11.39	5.649	330.8	571.6	49.47	13.40	36.36	478.9	1.03474
40.0	10.77	5.344	352.2	606.7	50.36	13.25	34.05	489.9	1.03284
41.0	10.25	5.083	372.3	639.9	51.18	13.14	32.31	500.2	1.03122
42.0	9.789	4.856	391.4	671.5	51.94	13.05	30.97	509.9	1.02981
43.0	9.383	4.654	409.7	701.9	52.65	12.99	29.90	519.1	1.02856
44.0	9.020	4.474	427.4	731.3	53.33	12.94	29.02	528.0	1.02745
45.0	8.692	4.312	444.6	760.0	53.97	12.91	28.29	536.5	1.02644
46.0	8.394	4.164	461.3	788.0	54.59	12.88	27.69	544.7	1.02552
47.0	8.120	4.028	477.7	815.4	55.18	12.87	27.17	552.6	1.02468
48.0	7.868	3.903	493.9	842.3	55.75	12.86	26.72	560.2	1.02391
50.0	7.418	3.679	525.4	895.0	56.82	12.86	26.01	574.8	1.02253
52.0	7.025	3.485	556.2	946.5	57.83	12.89	25.47	588.6	1.02133
54.0	6.679	3.313	586.5	997.0	58.78	12.94	25.06	601.6	1.02027
56.0	6.371	3.160	616.4	1047.0	59.69	13.01	24.75	613.9	1.01933
58.0	6.094	3.023	646.1	1096.0	60.55	13.11	24.52	625.5	1.01848
60.0	5.843	2.898	675.6	1145.0	61.38	13.22	24.36	636.5	1.01772
62.0	5.614	2.785	705.1	1193.0	62.18	13.36	24.26	646.9	1.01702
64.0	5.405	2.681	734.7	1242.0	62.95	13.51	24.21	656.8	1.01638

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
66.0	5.212	2.586	764.4	1290.0	63.69	13.69	24.21	666.2	1.01579
68.0	5.034	2.497	794.2	1339.0	64.42	13.89	24.24	675.2	1.01525
70.0	4.869	2.415	824.3	1387.0	65.12	14.11	24.32	683.7	1.01475
72.0	4.716	2.339	854.7	1436.0	65.81	14.34	24.42	691.8	1.01428
74.0	4.572	2.268	885.4	1485.0	66.48	14.59	24.56	699.6	1.01385
76.0	4.438	2.202	916.6	1534.0	67.13	14.86	24.72	707.1	1.01344
80.0	4.194	2.080	980.2	1634.0	68.41	15.43	25.12	721.2	1.01269
85.0	3.926	1.947	1063.0	1761.0	69.95	16.22	25.72	737.6	1.01188
90.0	3.692	1.831	1149.0	1891.0	71.44	17.05	26.40	753.0	1.01117
95.0	3.486	1.729	1239.0	2025.0	72.89	17.91	27.14	767.8	1.01054
100.0	3.303	1.638	1333.0	2163.0	74.30	18.78	27.91	782.1	1.00999
105.0	3.139	1.557	1431.0	2304.0	75.68	19.64	28.68	796.1	1.00949
110.0	2.991	1.483	1533.0	2450.0	77.03	20.46	29.42	810.0	1.00904
115.0	2.856	1.417	1639.0	2598.0	78.35	21.22	30.12	823.9	1.00863
120.0	2.734	1.356	1748.0	2751.0	79.65	21.92	30.76	837.9	1.00826
125.0	2.622	1.301	1860.0	2906.0	80.92	22.53	31.33	851.9	1.00792
130.0	2.519	1.250	1976.0	3064.0	82.16	23.06	31.81	866.1	1.00761
135.0	2.424	1.203	2093.0	3224.0	83.36	23.51	32.22	880.3	1.00732
140.0	2.337	1.159	2213.0	3386.0	84.54	23.90	32.58	894.5	1.00706
150.0	2.179	1.081	2456.0	3714.0	86.81	24.42	33.04	923.1	1.00658
160.0	2.042	1.013	2703.0	4046.0	88.95	24.68	33.26	951.8	1.00617
170.0	1.921	.9530	2952.0	4379.0	90.97	24.73	33.27	980.6	1.00580
180.0	1.814	.9000	3200.0	4711.0	92.86	24.62	33.13	1009.0	1.00548
190.0	1.719	.8525	3446.0	5041.0	94.65	24.41	32.89	1038.0	1.00519
200.0	1.633	.8099	3689.0	5368.0	96.33	24.13	32.59	1066.0	1.00493
210.0	1.555	.7714	3930.0	5693.0	97.91	23.81	32.26	1094.0	1.00469
220.0	1.485	.7364	4167.0	6014.0	99.40	23.49	31.92	1121.0	1.00448
230.0	1.420	.7045	4401.0	6331.0	100.8	23.18	31.59	1148.0	1.00429
240.0	1.361	.6753	4631.0	6645.0	102.2	22.88	31.28	1174.0	1.00411
250.0	1.307	.6484	4859.0	6957.0	103.4	22.60	31.00	1200.0	1.00394
260.0	1.257	.6235	5084.0	7265.0	104.6	22.36	30.74	1225.0	1.00379
270.0	1.211	.6006	5307.0	7572.0	105.8	22.14	30.52	1250.0	1.00365
280.0	1.168	.5792	5528.0	7876.0	106.9	21.95	30.32	1274.0	1.00352
300.0	1.090	.5408	5964.0	8479.0	109.0	21.64	30.00	1320.0	1.00329
320.0	1.022	.5072	6395.0	9076.0	110.9	21.42	29.77	1365.0	1.00308
340.0	.9626	.4775	6822.0	9670.0	112.7	21.27	29.61	1408.0	1.00290
360.0	.9094	.4511	7247.0	10260.0	114.4	21.16	29.50	1449.0	1.00274
380.0	.8618	.4275	7669.0	10850.0	116.0	21.09	29.42	1489.0	1.00260
400.0	.8190	.4063	8091.0	11440.0	117.5	21.04	29.36	1528.0	1.00247

1.38 MPa isobar

14.26*	77.70	38.54	-620.7	-584.9	10.12	10.92	14.56	1337.0	1.25397
15.0	77.13	38.26	-610.4	-574.4	10.84	10.20	14.04	1315.0	1.25197
16.0	76.34	37.87	-596.7	-560.3	11.75	10.02	14.25	1286.0	1.24918
18.0	74.63	37.02	-567.5	-530.2	13.52	10.63	15.93	1227.0	1.24319
20.0	72.72	36.07	-534.5	-496.3	15.31	11.38	18.09	1172.0	1.23653
22.0	70.58	35.01	-497.2	-457.8	17.14	11.96	20.42	1115.0	1.22905
24.0	68.13	33.80	-455.2	-414.4	19.03	12.38	23.04	1052.0	1.22057
25.0	66.77	33.12	-432.3	-390.6	20.00	12.55	24.55	1017.0	1.21586
26.0	65.29	32.39	-407.8	-365.2	20.99	12.69	26.28	978.8	1.21076
27.0	63.67	31.58	-381.6	-337.9	22.02	12.83	28.33	937.1	1.20518
28.0	61.87	30.69	-353.4	-308.4	23.10	12.96	30.86	891.0	1.19901
29.0	59.83	29.68	-322.5	-276.0	24.23	13.11	34.18	839.2	1.19205
29.5	58.69	29.11	-305.8	-258.4	24.84	13.19	36.30	810.7	1.18819
30.0	57.45	28.50	-288.0	-239.6	25.47	13.29	38.89	779.9	1.18398
30.5	56.09	27.82	-268.9	-219.3	26.14	13.40	42.17	746.6	1.17936
31.0	54.55	27.06	-248.2	-197.2	26.86	13.54	46.55	709.9	1.17418
31.5	52.78	26.18	-225.2	-172.5	27.65	13.72	52.80	669.0	1.16823
31.7	51.99	25.79	-215.1	-161.6	27.99	13.81	56.18	651.1	1.16555
31.8	51.56	25.58	-209.8	-155.9	28.17	13.86	58.14	641.7	1.16413
32.0	50.66	25.13	-198.7	-143.8	28.55	13.97	62.79	622.1	1.16109

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
32.2	49.66	24.63	-186.7	-130.7	28.96	14.10	68.82	601.0	1.15774
32.4	48.52	24.07	-173.5	-116.1	29.41	14.25	76.99	578.2	1.15397
32.6	47.22	23.42	-158.6	-99.6	29.92	14.44	88.83	553.0	1.14961
32.7	46.47	23.05	-150.2	-90.4	30.20	14.55	97.08	539.4	1.14713
32.8	45.63	22.64	-141.1	-80.1	30.51	14.68	107.9	524.8	1.14436
32.9	44.69	22.17	-130.9	-68.7	30.86	14.84	122.6	509.1	1.14122
33.0	43.58	21.62	-119.2	-55.4	31.26	15.02	144.1	492.0	1.13757
33.1	42.23	20.95	-105.3	-39.4	31.75	15.26	178.6	473.0	1.13313
33.2	40.48	20.08	-87.5	-18.8	32.37	15.56	242.2	451.5	1.12736
33.3	37.91	18.80	-61.8	11.7	33.29	16.00	388.5	426.6	1.11895
33.4	33.49	16.61	-17.2	65.9	34.91	16.63	714.3	400.3	1.10461
33.5	28.35	14.07	38.4	136.5	37.02	16.94	596.0	389.1	1.08808
33.6	25.36	12.58	74.0	183.7	38.43	16.81	373.9	389.2	1.07853
33.7	23.56	11.69	97.1	215.1	39.36	16.61	266.8	391.4	1.07282
33.8	22.31	11.07	114.0	238.7	40.06	16.41	209.2	394.0	1.06886
33.9	21.36	10.59	127.5	257.7	40.62	16.23	173.9	396.7	1.06586
34.0	20.59	10.21	138.7	273.8	41.10	16.07	150.0	399.3	1.06344
34.1	19.95	9.897	148.5	287.9	41.51	15.92	132.9	401.8	1.06142
34.2	19.40	9.623	157.1	300.5	41.88	15.78	119.9	404.2	1.05969
34.3	18.92	9.384	164.9	312.0	42.22	15.66	109.7	406.5	1.05818
34.4	18.49	9.170	172.1	322.6	42.52	15.54	101.6	408.8	1.05683
34.6	17.75	8.803	184.8	341.6	43.08	15.33	89.18	413.2	1.05451
34.8	17.12	8.495	196.0	358.4	43.56	15.14	80.20	417.3	1.05256
35.0	16.59	8.228	206.1	373.8	44.00	14.97	73.38	421.2	1.05089
35.2	16.12	7.994	215.3	387.9	44.40	14.83	68.00	424.9	1.04941
35.4	15.69	7.785	223.8	401.0	44.78	14.69	63.65	428.5	1.04810
35.6	15.31	7.597	231.7	413.4	45.12	14.57	60.04	431.9	1.04691
36.0	14.65	7.267	246.3	436.2	45.76	14.35	54.41	438.5	1.04485
36.5	13.95	6.921	262.7	462.1	46.48	14.13	49.30	446.1	1.04268
37.0	13.36	6.627	277.5	485.8	47.12	13.94	45.53	453.3	1.04084
37.5	12.85	6.373	291.2	507.8	47.71	13.78	42.63	460.0	1.03925
38.0	12.40	6.149	304.1	528.5	48.26	13.64	40.32	466.4	1.03785
38.5	11.99	5.948	316.2	548.2	48.77	13.53	38.44	472.6	1.03660
39.0	11.63	5.767	327.7	567.0	49.26	13.43	36.88	478.5	1.03548
40.0	10.99	5.451	349.4	602.6	50.16	13.27	34.45	489.5	1.03351
41.0	10.44	5.181	369.7	636.1	50.99	13.15	32.64	499.9	1.03183
42.0	9.972	4.947	389.0	668.0	51.76	13.07	31.23	509.6	1.03037
43.0	9.555	4.740	407.5	698.6	52.48	13.00	30.12	518.9	1.02909
44.0	9.182	4.554	425.3	728.3	53.16	12.95	29.21	527.8	1.02794
45.0	8.845	4.388	442.6	757.1	53.81	12.92	28.46	536.3	1.02691
46.0	8.539	4.236	459.4	785.2	54.43	12.89	27.83	544.5	1.02597
47.0	8.259	4.097	475.9	812.8	55.02	12.87	27.30	552.5	1.02511
48.0	8.001	3.969	492.1	839.9	55.59	12.87	26.84	560.2	1.02432
50.0	7.540	3.740	523.8	892.8	56.67	12.87	26.10	574.8	1.02291
52.0	7.139	3.541	554.7	944.4	57.68	12.89	25.55	588.6	1.02168
54.0	6.786	3.366	585.1	995.1	58.64	12.94	25.13	601.6	1.02060
56.0	6.472	3.210	615.1	1045.0	59.54	13.01	24.81	613.9	1.01964
58.0	6.189	3.070	644.9	1094.0	60.41	13.11	24.57	625.5	1.01877
60.0	5.934	2.943	674.5	1143.0	61.24	13.22	24.41	636.6	1.01799
62.0	5.701	2.828	704.0	1192.0	62.04	13.36	24.30	647.0	1.01728
64.0	5.488	2.722	733.6	1241.0	62.81	13.52	24.25	656.9	1.01663
66.0	5.292	2.625	763.3	1289.0	63.56	13.69	24.24	666.3	1.01604
68.0	5.111	2.535	793.2	1338.0	64.28	13.89	24.28	675.3	1.01549
70.0	4.943	2.452	823.4	1386.0	64.98	14.11	24.35	683.8	1.01497
72.0	4.787	2.375	853.8	1435.0	65.67	14.34	24.45	691.9	1.01450
74.0	4.641	2.302	884.6	1484.0	66.34	14.59	24.59	699.7	1.01405
76.0	4.505	2.235	915.8	1533.0	67.00	14.86	24.75	707.2	1.01364
80.0	4.256	2.111	979.5	1633.0	68.28	15.43	25.14	721.3	1.01288
85.0	3.984	1.976	1062.0	1760.0	69.82	16.22	25.74	737.7	1.01206
90.0	3.747	1.859	1148.0	1891.0	71.31	17.05	26.42	753.2	1.01134
95.0	3.537	1.755	1238.0	2025.0	72.76	17.92	27.16	767.9	1.01070
100.0	3.351	1.662	1332.0	2162.0	74.17	18.79	27.92	782.2	1.01013

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
105.0	3.185	1.580	1430.0	2304.0	75.55	19.64	28.69	796.3	1.00963
110.0	3.034	1.505	1532.0	2449.0	76.91	20.46	29.43	810.2	1.00917
115.0	2.898	1.438	1638.0	2598.0	78.23	21.22	30.13	824.1	1.00876
120.0	2.774	1.376	1747.0	2750.0	79.53	21.92	30.77	838.1	1.00838
125.0	2.661	1.320	1860.0	2906.0	80.79	22.53	31.33	852.1	1.00804
130.0	2.556	1.268	1975.0	3063.0	82.03	23.06	31.82	866.3	1.00772
135.0	2.460	1.220	2093.0	3224.0	83.24	23.51	32.23	880.5	1.00743
140.0	2.371	1.176	2212.0	3386.0	84.42	23.90	32.58	894.6	1.00716
150.0	2.211	1.097	2456.0	3714.0	86.68	24.42	33.05	923.3	1.00668
160.0	2.072	1.028	2703.0	4046.0	88.83	24.68	33.26	952.0	1.00626
170.0	1.949	.9669	2951.0	4379.0	90.84	24.73	33.27	980.8	1.00589
180.0	1.841	.9131	3199.0	4711.0	92.74	24.62	33.13	1009.0	1.00556
190.0	1.744	.8650	3446.0	5041.0	94.53	24.41	32.89	1038.0	1.00526
200.0	1.657	.8217	3689.0	5368.0	96.21	24.13	32.59	1066.0	1.00500
210.0	1.578	.7827	3929.0	5693.0	97.79	23.81	32.26	1094.0	1.00476
220.0	1.506	.7472	4167.0	6014.0	99.28	23.49	31.92	1121.0	1.00455
230.0	1.441	.7148	4400.0	6331.0	100.7	23.18	31.59	1148.0	1.00435
240.0	1.381	.6851	4631.0	6646.0	102.0	22.88	31.28	1174.0	1.00417
250.0	1.326	.6578	4859.0	6957.0	103.3	22.60	31.00	1200.0	1.00400
260.0	1.275	.6326	5084.0	7266.0	104.5	22.36	30.74	1225.0	1.00385
270.0	1.228	.6093	5307.0	7572.0	105.7	22.14	30.52	1250.0	1.00371
280.0	1.185	.5877	5528.0	7876.0	106.8	21.95	30.32	1274.0	1.00357
300.0	1.106	.5487	5964.0	8479.0	108.9	21.64	30.00	1321.0	1.00334
320.0	1.037	.5146	6395.0	9077.0	110.8	21.42	29.77	1365.0	1.00313
340.0	.9767	.4845	6822.0	9670.0	112.6	21.27	29.61	1408.0	1.00295
360.0	.9227	.4577	7246.0	10260.0	114.3	21.16	29.50	1449.0	1.00278
380.0	.8744	.4338	7669.0	10850.0	115.9	21.09	29.42	1489.0	1.00264
400.0	.8310	.4122	8090.0	11440.0	117.4	21.04	29.36	1528.0	1.00251

1.40 MPa isobar

14.26*	77.71	38.55	-620.7	-584.4	10.12	10.92	14.55	1336.0	1.25400
15.0	77.15	38.27	-610.5	-573.9	10.84	10.21	14.04	1315.0	1.25202
16.0	76.36	37.88	-596.8	-559.8	11.75	10.03	14.25	1286.0	1.24924
18.0	74.65	37.03	-567.6	-529.8	13.51	10.63	15.92	1228.0	1.24326
20.0	72.75	36.09	-534.7	-495.9	15.30	11.38	18.08	1173.0	1.23661
22.0	70.60	35.02	-497.4	-457.4	17.13	11.96	20.40	1116.0	1.22915
24.0	68.16	33.81	-455.5	-414.1	19.02	12.38	23.01	1053.0	1.22068
25.0	66.81	33.14	-432.6	-390.3	19.98	12.55	24.51	1018.0	1.21599
26.0	65.33	32.41	-408.2	-365.0	20.98	12.69	26.23	980.5	1.21090
27.0	63.72	31.61	-382.1	-337.8	22.01	12.82	28.26	939.2	1.20535
28.0	61.92	30.72	-353.9	-308.3	23.08	12.96	30.76	893.4	1.19922
29.0	59.90	29.71	-323.1	-276.0	24.21	13.10	34.02	842.0	1.19230
29.5	58.77	29.15	-306.5	-258.5	24.81	13.19	36.09	813.8	1.18847
30.0	57.55	28.55	-288.9	-239.8	25.44	13.28	38.62	783.4	1.18431
30.5	56.20	27.88	-270.0	-219.7	26.10	13.39	41.81	750.5	1.17974
31.0	54.69	27.13	-249.5	-197.8	26.81	13.53	46.01	714.4	1.17464
31.5	52.95	26.27	-226.7	-173.5	27.59	13.70	51.94	674.3	1.16880
31.7	52.18	25.88	-216.8	-162.8	27.93	13.78	55.10	656.8	1.16618
31.8	51.76	25.68	-211.7	-157.2	28.11	13.83	56.93	647.6	1.16480
32.0	50.88	25.24	-200.8	-145.4	28.48	13.93	61.22	628.5	1.16185
32.2	49.92	24.76	-189.1	-132.6	28.87	14.05	66.68	608.1	1.15862
32.4	48.84	24.23	-176.4	-118.6	29.31	14.20	73.93	586.1	1.15501
32.6	47.60	23.61	-162.1	-102.8	29.79	14.37	84.11	562.1	1.15089
32.8	46.14	22.89	-145.7	-84.6	30.35	14.59	99.64	535.5	1.14603
32.9	45.28	22.46	-136.4	-74.1	30.67	14.72	111.0	520.9	1.14319
33.0	44.31	21.98	-125.9	-62.2	31.03	14.88	126.6	505.1	1.13997
33.1	43.16	21.41	-113.9	-48.5	31.45	15.07	149.5	488.1	1.13619
33.2	41.77	20.72	-99.5	-31.9	31.95	15.31	185.9	469.2	1.13160
33.3	39.95	19.82	-81.0	-10.4	32.59	15.62	251.8	448.2	1.12564
33.4	37.34	18.52	-54.8	20.8	33.53	16.05	389.9	424.6	1.11711
33.5	33.30	16.52	-13.6	71.1	35.03	16.60	609.8	402.1	1.10400

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
33.6	28.92	14.35	33.9	131.4	36.83	16.86	538.9	392.1	1.08990
33.7	26.03	12.91	68.0	176.4	38.17	16.78	371.0	391.4	1.08066
33.8	24.18	11.99	91.3	208.1	39.10	16.60	272.3	393.1	1.07477
33.9	22.87	11.34	108.8	232.2	39.82	16.42	215.1	395.4	1.07063
34.0	21.87	10.85	122.7	251.8	40.39	16.25	179.1	397.9	1.06747
34.1	21.06	10.45	134.4	268.4	40.88	16.09	154.4	400.4	1.06492
34.2	20.39	10.11	144.5	282.9	41.31	15.94	136.6	402.8	1.06281
34.3	19.81	9.828	153.4	295.9	41.69	15.80	123.1	405.2	1.06099
34.4	19.31	9.578	161.4	307.6	42.03	15.68	112.5	407.5	1.05941
34.6	18.46	9.155	175.6	328.5	42.63	15.45	96.99	411.9	1.05673
34.8	17.75	8.807	187.8	346.7	43.16	15.25	86.09	416.1	1.05453
35.0	17.16	8.511	198.6	363.1	43.63	15.07	78.01	420.1	1.05266
35.2	16.64	8.253	208.4	378.0	44.05	14.92	71.75	423.9	1.05104
35.4	16.18	8.025	217.4	391.9	44.45	14.77	66.76	427.5	1.04961
35.6	15.77	7.820	225.8	404.8	44.81	14.64	62.67	431.0	1.04832
35.8	15.39	7.635	233.6	417.0	45.15	14.53	59.27	434.4	1.04716
36.0	15.05	7.466	241.0	428.5	45.47	14.42	56.38	437.6	1.04609
36.5	14.31	7.097	258.0	455.2	46.21	14.18	50.75	445.4	1.04378
37.0	13.68	6.787	273.3	479.6	46.87	13.98	46.66	452.6	1.04184
37.5	13.14	6.520	287.3	502.1	47.48	13.82	43.54	459.4	1.04017
38.0	12.67	6.285	300.4	523.2	48.04	13.68	41.07	465.9	1.03870
38.5	12.25	6.076	312.8	543.2	48.56	13.56	39.08	472.1	1.03740
39.0	11.87	5.887	324.5	562.3	49.05	13.45	37.43	478.0	1.03622
40.0	11.21	5.559	346.6	598.4	49.97	13.29	34.86	489.2	1.03418
41.0	10.64	5.280	367.1	632.3	50.80	13.17	32.96	499.6	1.03245
42.0	10.16	5.038	386.6	664.5	51.58	13.08	31.50	509.4	1.03094
43.0	9.727	4.825	405.2	695.4	52.31	13.01	30.34	518.7	1.02962
44.0	9.344	4.635	423.2	725.2	52.99	12.96	29.40	527.6	1.02844
45.0	8.999	4.464	440.6	754.2	53.64	12.92	28.63	536.2	1.02738
46.0	8.685	4.308	457.6	782.5	54.27	12.90	27.98	544.4	1.02642
47.0	8.398	4.166	474.2	810.2	54.86	12.88	27.43	552.4	1.02554
48.0	8.134	4.035	490.4	837.4	55.43	12.87	26.96	560.1	1.02473
50.0	7.663	3.801	522.2	890.5	56.52	12.87	26.20	574.8	1.02328
52.0	7.254	3.598	553.3	942.3	57.53	12.90	25.63	588.6	1.02203
54.0	6.894	3.420	583.7	993.1	58.49	12.95	25.20	601.6	1.02093
56.0	6.573	3.261	613.8	1043.0	59.40	13.02	24.87	613.9	1.01995
58.0	6.285	3.118	643.6	1093.0	60.27	13.11	24.63	625.6	1.01907
60.0	6.025	2.989	673.3	1142.0	61.10	13.22	24.45	636.6	1.01827
62.0	5.788	2.871	702.9	1191.0	61.90	13.36	24.35	647.1	1.01755
64.0	5.571	2.764	732.6	1239.0	62.67	13.52	24.29	657.0	1.01689
66.0	5.372	2.665	762.3	1288.0	63.42	13.69	24.28	666.4	1.01628
68.0	5.188	2.573	792.3	1336.0	64.15	13.89	24.31	675.4	1.01572
70.0	5.017	2.489	822.4	1385.0	64.85	14.11	24.38	683.9	1.01520
72.0	4.858	2.410	852.9	1434.0	65.54	14.34	24.48	692.1	1.01472
74.0	4.710	2.336	883.7	1483.0	66.21	14.59	24.61	699.9	1.01426
76.0	4.571	2.268	914.9	1532.0	66.87	14.86	24.77	707.3	1.01384
80.0	4.319	2.142	978.7	1632.0	68.15	15.44	25.16	721.5	1.01307
85.0	4.042	2.005	1061.0	1759.0	69.69	16.22	25.76	737.9	1.01223
90.0	3.801	1.886	1147.0	1890.0	71.19	17.05	26.44	753.3	1.01150
95.0	3.589	1.780	1237.0	2024.0	72.63	17.92	27.17	768.1	1.01086
100.0	3.400	1.686	1332.0	2162.0	74.05	18.79	27.93	782.4	1.01028
105.0	3.231	1.603	1430.0	2303.0	75.43	19.64	28.70	796.5	1.00977
110.0	3.078	1.527	1532.0	2449.0	76.78	20.46	29.44	810.4	1.00931
115.0	2.940	1.458	1638.0	2598.0	78.11	21.22	30.14	824.3	1.00889
120.0	2.814	1.396	1747.0	2750.0	79.40	21.92	30.78	838.2	1.00851
125.0	2.699	1.339	1859.0	2905.0	80.67	22.54	31.34	852.3	1.00816
130.0	2.593	1.286	1975.0	3063.0	81.91	23.06	31.83	866.4	1.00784
135.0	2.495	1.238	2092.0	3223.0	83.12	23.51	32.24	880.6	1.00754
140.0	2.405	1.193	2212.0	3385.0	84.30	23.90	32.59	894.8	1.00727
150.0	2.243	1.112	2455.0	3714.0	86.56	24.42	33.05	923.5	1.00677
160.0	2.101	1.042	2703.0	4046.0	88.70	24.68	33.27	952.2	1.00635
170.0	1.977	.9808	2951.0	4379.0	90.72	24.73	33.28	981.0	1.00597
180.0	1.867	.9262	3199.0	4711.0	92.62	24.62	33.14	1010.0	1.00564

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C, J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
190.0	1.769	.8774	3445.0	5041.0	94.41	24.41	32.90	1038.0	1.00534
200.0	1.680	.8335	3689.0	5368.0	96.09	24.13	32.59	1066.0	1.00507
210.0	1.600	.7939	3929.0	5693.0	97.67	23.81	32.26	1094.0	1.00483
220.0	1.528	.7579	4166.0	6014.0	99.16	23.49	31.92	1121.0	1.00461
230.0	1.462	.7250	4400.0	6331.0	100.6	23.18	31.60	1148.0	1.00441
240.0	1.401	.6949	4631.0	6646.0	101.9	22.88	31.29	1175.0	1.00423
250.0	1.345	.6673	4859.0	6957.0	103.2	22.61	31.00	1200.0	1.00406
260.0	1.294	.6417	5084.0	7266.0	104.4	22.36	30.75	1226.0	1.00390
270.0	1.246	.6181	5307.0	7572.0	105.5	22.14	30.52	1250.0	1.00376
280.0	1.202	.5961	5528.0	7876.0	106.7	21.95	30.32	1274.0	1.00363
300.0	1.122	.5566	5964.0	8479.0	108.7	21.64	30.00	1321.0	1.00339
320.0	1.052	.5220	6395.0	9077.0	110.7	21.42	29.77	1365.0	1.00317
340.0	.9907	.4914	6822.0	9671.0	112.5	21.27	29.61	1408.0	1.00299
360.0	.9360	.4643	7246.0	10260.0	114.2	21.16	29.50	1449.0	1.00282
380.0	.8870	.4400	7669.0	10850.0	115.7	21.09	29.42	1489.0	1.00268
400.0	.8429	.4181	8090.0	11440.0	117.3	21.04	29.37	1528.0	1.00254

1.45 MPa isobar

14.28*	77.73	38.56	-620.6	-583.0	10.13	10.92	14.52	1335.0	1.25409
15.0	77.19	38.29	-610.7	-572.8	10.83	10.22	14.02	1315.0	1.25216
16.0	76.40	37.90	-597.0	-558.7	11.73	10.04	14.23	1286.0	1.24939
18.0	74.70	37.05	-567.9	-528.8	13.50	10.63	15.90	1230.0	1.24344
20.0	72.81	36.11	-535.0	-494.9	15.28	11.38	18.04	1175.0	1.23681
22.0	70.67	35.06	-497.9	-456.5	17.11	11.96	20.35	1119.0	1.22938
24.0	68.25	33.85	-456.1	-413.3	18.99	12.38	22.94	1057.0	1.22097
25.0	66.90	33.19	-433.3	-389.6	19.95	12.54	24.42	1022.0	1.21631
26.0	65.44	32.46	-409.0	-364.4	20.94	12.69	26.10	985.0	1.21127
27.0	63.84	31.67	-383.1	-337.3	21.96	12.82	28.08	944.2	1.20578
28.0	62.07	30.79	-355.1	-308.1	23.03	12.95	30.51	899.2	1.19972
29.0	60.08	29.80	-324.7	-276.1	24.15	13.09	33.64	848.9	1.19292
30.0	57.78	28.66	-291.0	-240.4	25.36	13.26	37.99	791.8	1.18510
30.5	56.47	28.01	-272.4	-220.7	26.01	13.36	40.94	760.0	1.18066
31.0	55.01	27.29	-252.4	-199.3	26.71	13.49	44.77	725.2	1.17573
31.5	53.36	26.47	-230.4	-175.7	27.46	13.64	50.02	686.9	1.17015
32.0	51.41	25.50	-205.7	-148.8	28.31	13.85	57.85	643.8	1.16363
32.2	50.52	25.06	-194.7	-136.8	28.68	13.96	62.25	624.8	1.16064
32.4	49.54	24.58	-182.9	-123.9	29.08	14.08	67.83	604.6	1.15737
32.6	48.45	24.03	-169.9	-109.6	29.52	14.22	75.22	582.9	1.15372
32.8	47.20	23.41	-155.5	-93.6	30.01	14.39	85.51	559.2	1.14955
33.0	45.72	22.68	-139.0	-75.0	30.57	14.61	101.0	533.2	1.14465
33.2	43.89	21.77	-119.1	-52.5	31.25	14.90	127.0	504.0	1.13859
33.3	42.76	21.21	-107.2	-38.8	31.67	15.08	148.0	487.9	1.13488
33.4	41.42	20.55	-93.1	-22.6	32.15	15.30	179.2	470.5	1.13045
33.5	39.74	19.71	-75.9	-2.4	32.76	15.58	228.9	451.8	1.12495
33.6	37.55	18.63	-53.6	24.3	33.55	15.92	309.7	432.2	1.11780
33.7	34.66	17.19	-23.9	60.5	34.63	16.31	413.2	414.1	1.10839
33.8	31.37	15.56	11.2	104.4	35.93	16.61	444.0	402.3	1.09775
33.9	28.51	14.14	43.4	145.9	37.15	16.69	378.4	398.0	1.08859
34.0	26.38	13.08	68.9	179.8	38.15	16.61	301.2	397.5	1.08177
34.1	24.80	12.30	88.9	206.8	38.95	16.48	243.2	398.7	1.07674
34.2	23.58	11.70	105.0	229.0	39.60	16.33	202.5	400.6	1.07289
34.3	22.61	11.22	118.4	247.7	40.14	16.18	173.6	402.6	1.06981
34.4	21.81	10.82	129.9	264.0	40.62	16.04	152.4	404.8	1.06728
34.5	21.13	10.48	140.0	278.4	41.03	15.90	136.3	407.0	1.06512
34.6	20.54	10.19	149.0	291.3	41.41	15.77	123.7	409.2	1.06326
34.7	20.01	9.928	157.1	303.2	41.75	15.65	113.6	411.3	1.06163
34.8	19.55	9.698	164.6	314.1	42.07	15.54	105.3	413.4	1.06016
35.0	18.75	9.300	177.9	333.8	42.63	15.34	92.61	417.5	1.05765
35.2	18.08	8.966	189.7	351.4	43.13	15.16	83.26	421.4	1.05554
35.4	17.49	8.678	200.2	367.3	43.58	14.99	76.11	425.2	1.05372
35.6	16.98	8.425	209.8	381.9	43.99	14.84	70.44	428.8	1.05212
35.8	16.53	8.199	218.7	395.5	44.38	14.71	65.84	432.3	1.05070

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
36.0	16.12	7.996	227.0	408.3	44.73	14.59	62.03	435.6	1.04942
36.2	15.75	7.811	234.8	420.4	45.07	14.48	58.82	438.9	1.04826
36.5	15.24	7.562	245.7	437.4	45.53	14.32	54.84	443.6	1.04670
37.0	14.52	7.204	262.2	463.5	46.24	14.11	49.77	451.0	1.04445
37.5	13.91	6.900	277.3	487.4	46.89	13.92	46.00	458.0	1.04255
38.0	13.38	6.636	291.1	509.6	47.48	13.77	43.09	464.6	1.04090
38.5	12.91	6.403	304.1	530.6	48.02	13.64	40.76	470.9	1.03944
39.0	12.49	6.195	316.4	550.5	48.54	13.52	38.86	477.0	1.03814
39.5	12.11	6.007	328.1	569.5	49.02	13.42	37.28	482.8	1.03697
40.0	11.76	5.835	339.3	587.8	49.48	13.35	35.95	488.3	1.03590
41.0	11.15	5.532	360.5	622.6	50.34	13.21	33.82	498.9	1.03401
42.0	10.63	5.271	380.5	655.6	51.14	13.12	32.20	508.8	1.03239
43.0	10.16	5.042	399.6	687.1	51.88	13.04	30.92	518.2	1.03097
44.0	9.755	4.839	417.9	717.5	52.58	12.99	29.90	527.2	1.02970
45.0	9.387	4.656	435.6	747.0	53.24	12.94	29.06	535.9	1.02857
46.0	9.053	4.491	452.8	775.7	53.87	12.91	28.35	544.2	1.02755
47.0	8.749	4.340	469.6	803.7	54.47	12.89	27.76	552.2	1.02661
48.0	8.470	4.201	486.1	831.2	55.05	12.88	27.25	560.0	1.02575
50.0	7.973	3.955	518.3	884.9	56.15	12.88	26.44	574.7	1.02423
52.0	7.542	3.741	549.6	937.2	57.17	12.91	25.83	588.6	1.02291
54.0	7.163	3.553	580.3	988.3	58.14	12.95	25.37	601.7	1.02175
56.0	6.827	3.387	610.6	1039.0	59.05	13.02	25.02	614.1	1.02072
58.0	6.526	3.237	640.5	1088.0	59.93	13.12	24.76	625.8	1.01980
60.0	6.254	3.102	670.4	1138.0	60.76	13.23	24.58	636.9	1.01897
62.0	6.006	2.979	700.1	1187.0	61.57	13.37	24.45	647.3	1.01822
64.0	5.780	2.867	729.9	1236.0	62.34	13.52	24.39	657.3	1.01752
66.0	5.572	2.764	759.8	1284.0	63.09	13.70	24.37	666.7	1.01689
68.0	5.380	2.669	789.8	1333.0	63.82	13.90	24.39	675.7	1.01630
70.0	5.202	2.580	820.1	1382.0	64.53	14.11	24.46	684.2	1.01576
72.0	5.037	2.498	850.6	1431.0	65.22	14.35	24.55	692.4	1.01526
74.0	4.882	2.422	881.5	1480.0	65.89	14.60	24.68	700.2	1.01479
76.0	4.738	2.350	912.8	1530.0	66.55	14.87	24.84	707.7	1.01435
80.0	4.476	2.220	976.7	1630.0	67.84	15.44	25.22	721.8	1.01355
85.0	4.188	2.078	1059.0	1757.0	69.38	16.22	25.80	738.3	1.01268
90.0	3.938	1.953	1146.0	1888.0	70.88	17.06	26.48	753.7	1.01192
95.0	3.717	1.844	1236.0	2022.0	72.33	17.92	27.21	768.5	1.01125
100.0	3.521	1.747	1330.0	2160.0	73.74	18.79	27.97	782.8	1.01065
105.0	3.346	1.660	1428.0	2302.0	75.12	19.64	28.73	796.9	1.01012
110.0	3.188	1.581	1530.0	2447.0	76.48	20.46	29.47	810.8	1.00964
115.0	3.044	1.510	1636.0	2597.0	77.80	21.23	30.16	824.7	1.00920
120.0	2.914	1.445	1746.0	2749.0	79.10	21.92	30.80	838.7	1.00881
125.0	2.795	1.386	1858.0	2904.0	80.37	22.54	31.36	852.7	1.00845
130.0	2.685	1.332	1974.0	3062.0	81.61	23.07	31.85	866.9	1.00811
135.0	2.584	1.282	2091.0	3223.0	82.82	23.52	32.25	881.1	1.00781
140.0	2.490	1.235	2211.0	3385.0	84.00	23.90	32.61	895.3	1.00752
150.0	2.322	1.152	2455.0	3713.0	86.27	24.42	33.07	923.9	1.00701
160.0	2.176	1.079	2702.0	4045.0	88.41	24.69	33.28	952.7	1.00657
170.0	2.047	1.015	2950.0	4378.0	90.43	24.73	33.29	981.4	1.00618
180.0	1.933	.9589	3198.0	4711.0	92.33	24.63	33.15	1010.0	1.00584
190.0	1.831	.9084	3445.0	5041.0	94.11	24.41	32.90	1039.0	1.00553
200.0	1.740	.8630	3688.0	5369.0	95.79	24.13	32.60	1067.0	1.00525
210.0	1.657	.8219	3929.0	5693.0	97.37	23.82	32.27	1095.0	1.00500
220.0	1.582	.7847	4166.0	6014.0	98.87	23.49	31.93	1122.0	1.00478
230.0	1.513	.7507	4400.0	6332.0	100.3	23.18	31.60	1149.0	1.00457
240.0	1.450	.7195	4631.0	6646.0	101.6	22.88	31.29	1175.0	1.00438
250.0	1.393	.6909	4859.0	6957.0	102.9	22.61	31.01	1201.0	1.00420
260.0	1.339	.6644	5084.0	7266.0	104.1	22.36	30.75	1226.0	1.00404
270.0	1.290	.6399	5307.0	7572.0	105.3	22.14	30.52	1251.0	1.00389
280.0	1.244	.6172	5527.0	7877.0	106.4	21.95	30.32	1275.0	1.00375
300.0	1.162	.5763	5964.0	8480.0	108.4	21.64	30.00	1321.0	1.00351
320.0	1.090	.5405	6395.0	9077.0	110.4	21.42	29.77	1366.0	1.00329
340.0	1.026	.5089	6822.0	9671.0	112.2	21.27	29.61	1409.0	1.00310
360.0	.9692	.4808	7246.0	10260.0	113.9	21.16	29.50	1450.0	1.00292

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
380.0	.9185	.4556	7669.0	10850.0	115.5	21.09	29.42	1490.0	1.00277
400.0	.8728	.4330	8090.0	11440.0	117.0	21.04	29.37	1528.0	1.00263
1.50 MPa isobar									
14.30*	77.76	38.57	-620.6	-581.7	10.13	10.91	14.49	1335.0	1.25418
15.0	77.23	38.31	-610.9	-571.7	10.81	10.24	14.01	1315.0	1.25230
16.0	76.44	37.92	-597.2	-557.6	11.72	10.05	14.21	1287.0	1.24954
18.0	74.75	37.08	-568.2	-527.7	13.48	10.63	15.88	1231.0	1.24361
20.0	72.86	36.14	-535.4	-493.9	15.26	11.38	18.01	1177.0	1.23701
22.0	70.74	35.09	-498.3	-455.6	17.09	11.96	20.30	1121.0	1.22962
24.0	68.33	33.90	-456.7	-412.5	18.96	12.38	22.86	1060.0	1.22126
25.0	66.99	33.23	-434.0	-388.9	19.92	12.54	24.32	1026.0	1.21663
26.0	65.54	32.51	-409.9	-363.8	20.91	12.68	25.98	989.3	1.21163
27.0	63.96	31.73	-384.1	-336.8	21.92	12.81	27.91	949.2	1.20620
28.0	62.22	30.86	-356.4	-307.8	22.98	12.94	30.27	904.9	1.20021
29.0	60.26	29.89	-326.3	-276.1	24.09	13.07	33.28	855.7	1.19352
30.0	58.01	28.77	-293.0	-240.9	25.28	13.24	37.40	800.0	1.18586
30.5	56.73	28.14	-274.8	-221.5	25.93	13.33	40.16	769.1	1.18154
31.0	55.32	27.44	-255.2	-200.6	26.61	13.45	43.67	735.6	1.17677
31.5	53.73	26.65	-233.9	-177.6	27.34	13.59	48.37	698.9	1.17141
32.0	51.90	25.74	-210.1	-151.9	28.15	13.78	55.11	658.0	1.16524
32.2	51.07	25.33	-199.7	-140.5	28.50	13.87	58.75	640.2	1.16246
32.4	50.16	24.88	-188.6	-128.3	28.88	13.98	63.24	621.4	1.15944
32.6	49.17	24.39	-176.6	-115.1	29.29	14.10	68.92	601.4	1.15613
32.8	48.07	23.84	-163.5	-100.6	29.73	14.24	76.39	579.9	1.15244
33.0	46.80	23.22	-149.0	-84.4	30.22	14.41	86.70	556.7	1.14824
33.2	45.32	22.48	-132.4	-65.6	30.79	14.63	101.9	531.5	1.14332
33.4	43.50	21.58	-112.5	-43.0	31.47	14.91	126.6	503.5	1.13730
33.5	42.40	21.03	-100.8	-29.5	31.88	15.08	145.4	488.4	1.13368
33.6	41.11	20.39	-87.2	-13.7	32.35	15.28	171.7	472.4	1.12944
33.7	39.57	19.63	-71.2	5.3	32.91	15.52	209.1	455.8	1.12438
33.8	37.68	18.69	-51.6	28.6	33.60	15.81	260.7	439.1	1.11821
33.9	35.39	17.55	-27.8	57.6	34.46	16.11	318.3	423.9	1.11076
34.0	32.84	16.29	-	91.4	35.45	16.37	350.1	412.6	1.10250
34.1	30.38	15.07	26.5	126.1	36.47	16.51	335.6	406.4	1.09458
34.2	28.29	14.03	50.8	157.7	37.40	16.52	295.1	403.9	1.08788
34.3	26.60	13.20	71.4	185.0	38.19	16.45	252.2	403.7	1.08249
34.4	25.25	12.52	88.6	208.4	38.87	16.34	215.9	404.6	1.07818
34.5	24.14	11.98	103.2	228.4	39.46	16.22	187.3	406.0	1.07467
34.6	23.23	11.52	115.8	246.0	39.97	16.09	165.0	407.7	1.07176
34.7	22.45	11.13	126.9	261.6	40.42	15.96	147.5	409.6	1.06929
34.8	21.77	10.80	136.7	275.6	40.82	15.84	133.6	411.6	1.06716
34.9	21.18	10.51	145.6	288.4	41.19	15.72	122.4	413.5	1.06530
35.0	20.65	10.25	153.8	300.2	41.52	15.61	113.1	415.5	1.06364
35.2	19.75	9.799	168.2	321.3	42.12	15.41	98.81	419.4	1.06080
35.4	19.00	9.426	180.8	340.0	42.65	15.22	88.34	423.2	1.05844
35.6	18.36	9.107	192.1	356.8	43.13	15.06	80.34	426.8	1.05642
35.8	17.80	8.828	202.3	372.2	43.56	14.91	74.04	430.4	1.05466
36.0	17.30	8.581	211.7	386.5	43.96	14.77	68.95	433.8	1.05311
36.2	16.85	8.359	220.4	399.8	44.33	14.64	64.74	437.1	1.05171
36.4	16.45	8.158	228.6	412.4	44.67	14.53	61.21	440.4	1.05044
37.0	15.42	7.649	250.5	446.6	45.61	14.23	53.35	449.6	1.04724
37.5	14.72	7.302	266.7	472.1	46.29	14.03	48.79	456.7	1.04507
38.0	14.12	7.004	281.5	495.6	46.91	13.86	45.33	463.5	1.04320
38.5	13.60	6.745	295.2	517.6	47.49	13.72	42.61	469.9	1.04158
39.0	13.13	6.514	308.0	538.3	48.02	13.59	40.42	476.0	1.04014
39.5	12.71	6.307	320.2	558.0	48.52	13.49	38.61	481.9	1.03884
40.0	12.34	6.120	331.8	577.0	49.00	13.40	37.11	487.5	1.03767
41.0	11.67	5.790	353.8	612.8	49.89	13.26	34.73	498.2	1.03562
42.0	11.11	5.509	374.3	646.6	50.70	13.15	32.93	508.3	1.03387
43.0	10.61	5.263	393.8	678.8	51.46	13.07	31.53	517.8	1.03234
44.0	10.17	5.046	412.5	709.8	52.17	13.01	30.41	526.9	1.03099

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
45.0	9.780	4.851	430.5	739.7	52.84	12.97	29.50	535.6	1.02978
46.0	9.426	4.676	448.0	768.8	53.48	12.93	28.74	544.0	1.02869
47.0	9.104	4.516	465.1	797.2	54.09	12.91	28.10	552.1	1.02770
48.0	8.809	4.370	481.8	825.0	54.68	12.90	27.56	559.9	1.02680
50.0	8.285	4.110	514.3	879.3	55.79	12.89	26.69	574.7	1.02519
52.0	7.832	3.885	545.9	932.0	56.82	12.91	26.04	588.7	1.02380
54.0	7.435	3.688	576.8	983.5	57.79	12.96	25.55	601.8	1.02258
56.0	7.083	3.513	607.3	1034.0	58.72	13.03	25.18	614.2	1.02151
58.0	6.767	3.357	637.5	1084.0	59.59	13.12	24.90	626.0	1.02054
60.0	6.483	3.216	667.4	1134.0	60.43	13.23	24.70	637.1	1.01967
62.0	6.225	3.088	697.3	1183.0	61.24	13.37	24.56	647.6	1.01888
64.0	5.989	2.971	727.2	1232.0	62.02	13.53	24.49	657.6	1.01816
66.0	5.772	2.863	757.2	1281.0	62.77	13.70	24.46	667.0	1.01750
68.0	5.572	2.764	787.4	1330.0	63.50	13.90	24.48	676.0	1.01689
70.0	5.387	2.672	817.7	1379.0	64.21	14.12	24.53	684.6	1.01633
72.0	5.215	2.587	848.4	1428.0	64.91	14.35	24.62	692.8	1.01580
74.0	5.055	2.507	879.3	1478.0	65.58	14.60	24.75	700.6	1.01531
76.0	4.905	2.433	910.7	1527.0	66.24	14.87	24.90	708.1	1.01486
80.0	4.632	2.298	974.7	1628.0	67.53	15.44	25.27	722.2	1.01403
85.0	4.334	2.150	1058.0	1755.0	69.08	16.23	25.85	738.7	1.01312
90.0	4.075	2.021	1144.0	1886.0	70.58	17.06	26.52	754.1	1.01233
95.0	3.846	1.908	1234.0	2021.0	72.03	17.92	27.25	768.9	1.01164
100.0	3.643	1.807	1329.0	2159.0	73.45	18.79	28.00	783.2	1.01102
105.0	3.461	1.717	1427.0	2301.0	74.83	19.65	28.76	797.3	1.01047
110.0	3.297	1.636	1529.0	2446.0	76.18	20.47	29.49	811.2	1.00997
115.0	3.149	1.562	1635.0	2595.0	77.51	21.23	30.19	825.2	1.00952
120.0	3.014	1.495	1745.0	2748.0	78.81	21.93	30.82	839.1	1.00911
125.0	2.890	1.434	1857.0	2904.0	80.08	22.54	31.38	853.2	1.00874
130.0	2.777	1.377	1973.0	3062.0	81.32	23.07	31.86	867.3	1.00839
135.0	2.672	1.325	2090.0	3222.0	82.53	23.52	32.27	881.6	1.00807
140.0	2.575	1.277	2210.0	3384.0	83.71	23.91	32.62	895.7	1.00778
150.0	2.401	1.191	2454.0	3713.0	85.98	24.43	33.08	924.4	1.00725
160.0	2.250	1.116	2701.0	4045.0	88.12	24.69	33.29	953.1	1.00680
170.0	2.117	1.050	2950.0	4378.0	90.14	24.74	33.30	981.9	1.00639
180.0	1.999	.9916	3198.0	4711.0	92.04	24.63	33.16	1011.0	1.00604
190.0	1.894	.9394	3444.0	5041.0	93.83	24.41	32.91	1039.0	1.00572
200.0	1.799	.8924	3688.0	5369.0	95.51	24.13	32.61	1067.0	1.00543
210.0	1.714	.8500	3928.0	5693.0	97.09	23.82	32.27	1095.0	1.00517
220.0	1.636	.8114	4166.0	6014.0	98.58	23.50	31.94	1122.0	1.00494
230.0	1.565	.7763	4399.0	6332.0	100.00	23.18	31.61	1149.0	1.00472
240.0	1.500	.7441	4630.0	6646.0	101.3	22.88	31.29	1175.0	1.00453
250.0	1.440	.7144	4858.0	6958.0	102.6	22.61	31.01	1201.0	1.00435
260.0	1.385	.6871	5083.0	7267.0	103.8	22.36	30.75	1226.0	1.00418
270.0	1.334	.6618	5306.0	7573.0	105.0	22.14	30.53	1251.0	1.00403
280.0	1.287	.6383	5527.0	7877.0	106.1	21.95	30.33	1275.0	1.00388
300.0	1.201	.5960	5963.0	8480.0	108.2	21.64	30.01	1322.0	1.00363
320.0	1.127	.5589	6394.0	9078.0	110.1	21.42	29.78	1366.0	1.00340
340.0	1.061	.5263	6822.0	9672.0	111.9	21.27	29.62	1409.0	1.00320
360.0	1.002	.4972	7246.0	10260.0	113.6	21.16	29.50	1450.0	1.00302
380.0	.9499	.4712	7669.0	10850.0	115.2	21.09	29.42	1490.0	1.00287
400.0	.9027	.4478	8090.0	11440.0	116.7	21.04	29.37	1529.0	1.00272

1.60 MPa isobar

14.33 ^a	77.81	38.60	-620.4	-579.0	10.14	10.90	14.44	1333.0	1.25436
15.0	77.30	38.35	-611.2	-569.5	10.79	10.26	13.99	1316.0	1.25258
16.0	76.53	37.96	-597.6	-555.4	11.69	10.07	14.18	1288.0	1.24984
18.0	74.85	37.13	-568.7	-525.6	13.45	10.64	15.83	1234.0	1.24395
20.0	72.98	36.20	-536.0	-491.8	15.23	11.38	17.95	1181.0	1.23741
22.0	70.87	35.16	-499.2	-453.7	17.04	11.96	20.21	1127.0	1.23008
24.0	68.49	33.98	-457.9	-410.8	18.90	12.37	22.72	1067.0	1.22182
26.0	65.75	32.62	-411.6	-362.5	20.84	12.67	25.74	997.8	1.21235
27.0	64.20	31.85	-386.1	-335.9	21.84	12.80	27.59	958.8	1.20702

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C, J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
28.0	62.50	31.00	-358.8	-307.2	22.88	12.92	29.82	916.0	1.20117
29.0	60.60	30.06	-329.3	-276.0	23.98	13.05	32.62	868.7	1.19468
30.0	58.43	28.99	-296.8	-241.6	25.14	13.20	36.35	815.6	1.18731
30.5	57.22	28.38	-279.3	-222.9	25.76	13.28	38.78	786.4	1.18320
31.0	55.89	27.73	-260.5	-202.8	26.42	13.39	41.78	755.0	1.17870
31.5	54.42	26.99	-240.2	-181.0	27.12	13.51	45.64	721.0	1.17373
32.0	52.75	26.17	-218.1	-156.9	27.87	13.66	50.86	683.8	1.16812
32.5	50.81	25.20	-193.2	-129.7	28.72	13.86	58.47	642.5	1.16161
32.7	49.93	24.77	-182.2	-117.6	29.09	13.96	62.62	624.5	1.15865
32.8	49.46	24.53	-176.4	-111.2	29.28	14.01	65.05	615.2	1.15708
33.0	48.45	24.03	-164.2	-97.7	29.69	14.14	70.83	595.7	1.15371
33.2	47.32	23.47	-150.9	-82.8	30.14	14.28	78.31	575.1	1.14997
33.4	46.05	22.84	-136.2	-66.2	30.64	14.45	88.38	553.0	1.14574
33.6	44.57	22.11	-119.5	-47.2	31.21	14.65	102.6	529.4	1.14084
33.8	42.80	21.23	-100.0	-24.7	31.88	14.90	123.6	504.2	1.13501
34.0	40.61	20.14	-76.4	3.0	32.69	15.22	156.0	477.6	1.12779
34.1	39.29	19.49	-62.4	19.7	33.18	15.41	177.8	464.3	1.12349
34.2	37.81	18.76	-46.6	38.7	33.74	15.61	202.4	451.5	1.11864
34.3	36.16	17.94	-29.0	60.2	34.37	15.81	226.3	440.0	1.11327
34.4	34.41	17.07	-10.0	83.7	35.05	15.99	243.2	430.6	1.10757
34.5	32.63	16.19	9.6	108.4	35.77	16.13	248.1	423.7	1.10183
34.6	30.95	15.35	28.7	133.0	36.48	16.21	241.2	419.3	1.09640
34.7	29.41	14.59	46.7	156.4	37.16	16.23	226.6	416.9	1.09147
34.8	28.06	13.92	63.2	178.2	37.78	16.20	208.6	415.9	1.08713
34.9	26.87	13.33	78.1	198.1	38.36	16.14	190.4	415.8	1.08334
35.0	25.84	12.82	91.5	216.3	38.88	16.06	173.4	416.3	1.08006
35.1	24.94	12.37	103.5	232.9	39.35	15.97	158.3	417.3	1.07719
35.2	24.14	11.98	114.4	248.0	39.78	15.87	145.2	418.5	1.07467
35.3	23.44	11.63	124.4	262.0	40.18	15.78	133.9	419.9	1.07244
35.4	22.81	11.32	133.5	274.9	40.54	15.68	124.3	421.4	1.07046
35.6	21.74	10.78	149.7	298.1	41.19	15.49	108.7	424.7	1.06705
35.8	20.84	10.34	163.8	318.6	41.77	15.31	96.90	428.0	1.06422
36.0	20.08	9.959	176.4	337.0	42.28	15.15	87.76	431.3	1.06182
36.2	19.41	9.630	187.7	353.8	42.75	15.00	80.51	434.6	1.05974
36.4	18.83	9.341	198.0	369.3	43.17	14.86	74.62	437.9	1.05791
36.6	18.31	9.083	207.6	383.7	43.57	14.73	69.77	441.0	1.05627
36.8	17.84	8.850	216.5	397.3	43.94	14.61	65.69	444.2	1.05480
37.0	17.41	8.638	224.8	410.1	44.28	14.50	62.23	447.2	1.05347
37.5	16.49	8.180	243.8	439.4	45.07	14.26	55.49	454.5	1.05058
38.0	15.72	7.800	260.7	465.9	45.77	14.06	50.60	461.5	1.04819
38.5	15.07	7.475	276.1	490.2	46.41	13.89	46.88	468.1	1.04615
39.0	14.50	7.191	290.4	512.9	46.99	13.75	43.96	474.4	1.04437
39.5	13.99	6.941	303.7	534.2	47.54	13.62	41.61	480.5	1.04280
40.0	13.54	6.716	316.3	554.6	48.05	13.52	39.69	486.2	1.04140
40.5	13.13	6.513	328.3	574.0	48.53	13.43	38.07	491.8	1.04013
41.0	12.76	6.328	339.8	592.7	48.99	13.35	36.70	497.1	1.03897
42.0	12.10	6.000	361.6	628.2	49.85	13.23	34.51	507.4	1.03693
43.0	11.53	5.718	382.0	661.9	50.64	13.13	32.83	517.1	1.03517
44.0	11.03	5.471	401.5	694.0	51.38	13.06	31.50	526.4	1.03363
45.0	10.58	5.251	420.2	724.9	52.07	13.01	30.43	535.2	1.03226
46.0	10.19	5.053	438.3	754.9	52.73	12.97	29.55	543.7	1.03104
47.0	9.827	4.874	455.8	784.1	53.36	12.94	28.81	551.9	1.02993
48.0	9.498	4.711	473.0	812.6	53.96	12.92	28.19	559.8	1.02891
50.0	8.917	4.423	506.2	867.9	55.09	12.91	27.20	574.8	1.02713
52.0	8.418	4.176	538.4	921.5	56.14	12.93	26.47	588.8	1.02560
54.0	7.982	3.960	569.8	973.9	57.13	12.97	25.91	602.1	1.02426
56.0	7.597	3.769	600.7	1025.0	58.06	13.04	25.49	614.6	1.02308
58.0	7.254	3.598	631.3	1076.0	58.95	13.13	25.17	626.4	1.02203
60.0	6.945	3.445	661.6	1126.0	59.80	13.25	24.94	637.6	1.02108
62.0	6.664	3.306	691.7	1176.0	60.62	13.38	24.78	648.2	1.02023
64.0	6.409	3.179	721.9	1225.0	61.40	13.54	24.69	658.2	1.01944
66.0	6.174	3.063	752.1	1275.0	62.16	13.71	24.64	667.7	1.01873

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
68.0	5.958	2.956	782.5	1324.0	62.90	13.91	24.64	676.7	1.01807
70.0	5.759	2.857	813.0	1373.0	63.61	14.13	24.69	685.3	1.01746
72.0	5.573	2.765	843.8	1423.0	64.31	14.36	24.77	693.5	1.01689
74.0	5.401	2.679	875.0	1472.0	64.99	14.61	24.88	701.3	1.01637
76.0	5.239	2.599	906.5	1522.0	65.65	14.88	25.02	708.8	1.01588
80.0	4.946	2.454	970.8	1623.0	66.95	15.45	25.38	723.0	1.01498
85.0	4.626	2.295	1054.0	1751.0	68.50	16.24	25.95	739.5	1.01401
90.0	4.348	2.157	1141.0	1883.0	70.00	17.07	26.60	755.0	1.01316
95.0	4.103	2.035	1231.0	2017.0	71.46	17.93	27.32	769.8	1.01242
100.0	3.886	1.927	1326.0	2156.0	72.88	18.80	28.06	784.1	1.01176
105.0	3.691	1.831	1424.0	2298.0	74.27	19.65	28.82	798.2	1.01117
110.0	3.516	1.744	1527.0	2444.0	75.63	20.47	29.55	812.1	1.01064
115.0	3.358	1.666	1633.0	2593.0	76.95	21.24	30.23	826.0	1.01015
120.0	3.213	1.594	1742.0	2746.0	78.25	21.93	30.86	840.0	1.00972
125.0	3.081	1.528	1855.0	2902.0	79.53	22.55	31.42	854.1	1.00932
130.0	2.960	1.468	1971.0	3060.0	80.77	23.08	31.90	868.2	1.00895
135.0	2.848	1.413	2088.0	3221.0	81.98	23.52	32.30	882.5	1.00861
140.0	2.745	1.362	2208.0	3383.0	83.16	23.91	32.65	896.6	1.00830
150.0	2.560	1.270	2452.0	3712.0	85.43	24.43	33.11	925.3	1.00773
160.0	2.398	1.190	2700.0	4044.0	87.57	24.69	33.31	954.1	1.00725
170.0	2.256	1.119	2948.0	4378.0	89.60	24.74	33.32	982.8	1.00682
180.0	2.131	1.057	3197.0	4710.0	91.50	24.63	33.17	1012.0	1.00644
190.0	2.018	1.001	3443.0	5041.0	93.28	24.42	32.93	1040.0	1.00610
200.0	1.918	.9512	3687.0	5369.0	94.97	24.13	32.62	1068.0	1.00579
210.0	1.826	.9060	3927.0	5693.0	96.55	23.82	32.29	1096.0	1.00551
220.0	1.744	.8649	4165.0	6014.0	98.04	23.50	31.95	1123.0	1.00526
230.0	1.668	.8275	4399.0	6332.0	99.46	23.18	31.62	1150.0	1.00504
240.0	1.599	.7931	4630.0	6647.0	100.8	22.89	31.30	1176.0	1.00483
250.0	1.535	.7616	4857.0	6958.0	102.1	22.61	31.02	1202.0	1.00463
260.0	1.477	.7324	5083.0	7267.0	103.3	22.36	30.76	1227.0	1.00446
270.0	1.422	.7054	5306.0	7574.0	104.4	22.14	30.53	1252.0	1.00429
280.0	1.372	.6804	5526.0	7878.0	105.5	21.95	30.33	1276.0	1.00414
300.0	1.281	.6253	5963.0	8481.0	107.6	21.65	30.01	1322.0	1.00387
320.0	1.201	.5959	6394.0	9079.0	109.6	21.42	29.78	1367.0	1.00362
340.0	1.131	.5610	6821.0	9673.0	111.4	21.27	29.62	1410.0	1.00341
360.0	1.069	.5301	7246.0	10260.0	113.0	21.17	29.51	1451.0	1.00322
380.0	1.013	.5024	7669.0	10850.0	114.6	21.09	29.43	1491.0	1.00306
400.0	.9624	.4774	8090.0	11440.0	116.1	21.04	29.37	1529.0	1.00290

1.70 MPa isobar

14.36 ^a	77.86	38.62	-620.3	-576.3	10.15	10.89	14.38	1332.0	1.25453
15.0	77.38	38.39	-611.5	-567.3	10.76	10.29	13.97	1316.0	1.25286
16.0	76.61	38.00	-598.0	-553.3	11.67	10.08	14.15	1290.0	1.25014
18.0	74.95	37.18	-569.2	-523.5	13.42	10.65	15.79	1237.0	1.24429
20.0	73.09	36.26	-536.7	-489.8	15.19	11.38	17.88	1186.0	1.23780
22.0	71.01	35.22	-500.1	-451.8	17.00	11.96	20.12	1132.0	1.23054
24.0	68.65	34.06	-459.1	-409.2	18.85	12.37	22.58	1073.0	1.22238
26.0	65.95	32.72	-413.2	-361.2	20.77	12.66	25.51	1006.0	1.21304
27.0	64.43	31.96	-388.0	-334.8	21.76	12.79	27.29	968.2	1.20781
28.0	62.77	31.14	-361.1	-306.5	22.79	12.90	29.41	926.7	1.20210
29.0	60.92	30.22	-332.1	-275.9	23.87	13.03	32.02	881.1	1.19578
30.0	58.83	29.18	-300.5	-242.2	25.01	13.16	35.43	830.3	1.18868
30.5	57.68	28.61	-283.4	-224.0	25.61	13.24	37.59	802.6	1.18474
31.0	56.42	27.99	-265.3	-204.5	26.24	13.33	40.21	773.0	1.18048
31.5	55.04	27.30	-245.9	-183.7	26.91	13.44	43.47	741.2	1.17582
32.0	53.50	26.54	-225.0	-160.9	27.63	13.57	47.70	706.9	1.17063
32.5	51.75	25.67	-201.9	-135.7	28.41	13.73	53.47	669.4	1.16476
32.7	50.98	25.29	-191.9	-124.7	28.75	13.81	56.44	653.3	1.16216
32.8	50.57	25.08	-186.8	-119.0	28.92	13.85	58.12	645.1	1.16079
33.0	49.70	24.66	-175.9	-107.0	29.29	13.94	61.95	628.0	1.15791
33.5	47.20	23.41	-145.5	-72.9	30.31	14.23	75.75	581.6	1.14955

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
33.7	46.00	22.82	-131.4	-57.0	30.79	14.38	84.02	561.4	1.14558
33.8	45.35	22.49	-123.9	-48.3	31.04	14.46	89.08	550.9	1.14341
34.0	43.90	21.77	-107.4	-29.3	31.60	14.65	101.7	529.2	1.13861
34.2	42.21	20.94	-88.5	-7.3	32.25	14.88	118.8	506.7	1.13305
34.4	40.21	19.95	-66.6	18.6	33.01	15.14	141.6	484.2	1.12650
34.6	37.86	18.78	-40.9	49.6	33.90	15.44	168.2	463.0	1.11881
34.8	35.21	17.47	-11.7	85.6	34.94	15.71	189.7	445.9	1.11018
35.0	32.51	16.12	18.9	124.3	36.05	15.90	194.2	434.8	1.10142
35.2	30.03	14.90	48.1	162.2	37.13	15.96	182.6	429.3	1.09346
35.3	28.93	14.35	61.6	180.0	37.63	15.94	173.6	428.1	1.08994
35.4	27.93	13.86	74.2	196.9	38.11	15.91	163.7	427.6	1.08674
35.5	27.02	13.41	85.9	212.8	38.56	15.85	153.9	427.6	1.08383
35.6	26.20	13.00	96.9	227.7	38.98	15.79	144.4	428.0	1.08121
35.7	25.45	12.63	107.0	241.7	39.37	15.72	135.5	428.7	1.07883
35.8	24.78	12.29	116.5	254.8	39.74	15.65	127.4	429.6	1.07667
36.0	23.59	11.70	133.6	278.8	40.41	15.49	113.4	431.9	1.07291
36.2	22.59	11.20	148.6	300.3	41.00	15.33	102.0	434.5	1.06974
36.4	21.73	10.78	162.1	319.8	41.54	15.18	92.79	437.3	1.06703
36.6	20.98	10.41	174.2	337.6	42.03	15.04	85.25	440.2	1.06467
36.8	20.32	10.08	185.3	354.0	42.47	14.91	79.03	443.1	1.06259
37.0	19.74	9.790	195.6	369.2	42.89	14.78	73.82	446.1	1.06075
37.2	19.21	9.527	205.1	383.6	43.27	14.67	69.42	449.0	1.05908
37.4	18.73	9.289	214.0	397.1	43.63	14.56	65.65	451.8	1.05758
37.6	18.29	9.071	222.4	409.8	43.98	14.46	62.40	454.7	1.05620
38.0	17.51	8.686	238.0	433.7	44.61	14.27	57.08	460.2	1.05377
38.5	16.68	8.276	255.5	460.9	45.32	14.08	52.02	466.9	1.05119
39.0	15.98	7.927	271.4	485.9	45.96	13.91	48.15	473.3	1.04899
39.5	15.37	7.622	286.2	509.2	46.56	13.76	45.10	479.4	1.04707
40.0	14.82	7.353	299.9	531.1	47.11	13.65	42.64	485.3	1.04539
40.5	14.34	7.112	312.9	551.9	47.63	13.54	40.62	490.9	1.04388
41.0	13.90	6.895	325.2	571.8	48.11	13.45	38.92	496.4	1.04251
42.0	13.13	6.514	348.3	609.3	49.02	13.31	36.24	506.8	1.04014
43.0	12.48	6.191	369.9	644.5	49.85	13.20	34.23	516.7	1.03812
44.0	11.91	5.910	390.2	677.9	50.61	13.12	32.67	526.0	1.03636
45.0	11.41	5.662	409.7	709.9	51.33	13.05	31.42	535.0	1.03482
46.0	10.97	5.441	428.3	740.8	52.01	13.01	30.40	543.6	1.03344
47.0	10.57	5.241	446.4	770.8	52.66	12.97	29.56	551.8	1.03220
48.0	10.20	5.060	464.0	800.0	53.27	12.95	28.85	559.8	1.03108
49.0	9.867	4.895	481.2	828.5	53.86	12.94	28.25	567.5	1.03005
50.0	9.560	4.742	498.0	856.5	54.43	12.93	27.73	574.9	1.02911
52.0	9.012	4.471	530.8	911.1	55.50	12.95	26.91	589.1	1.02742
54.0	8.536	4.234	562.8	964.3	56.50	12.99	26.28	602.5	1.02596
56.0	8.117	4.027	594.1	1016.0	57.45	13.05	25.81	615.1	1.02467
58.0	7.744	3.842	625.0	1068.0	58.35	13.14	25.45	626.9	1.02353
60.0	7.409	3.675	655.7	1118.0	59.20	13.26	25.19	638.2	1.02251
62.0	7.107	3.525	686.1	1168.0	60.03	13.39	25.01	648.8	1.02158
64.0	6.831	3.388	716.6	1218.0	60.82	13.54	24.89	658.8	1.02073
66.0	6.578	3.263	747.0	1268.0	61.58	13.72	24.83	668.4	1.01996
68.0	6.346	3.148	777.6	1318.0	62.32	13.92	24.81	677.4	1.01925
70.0	6.131	3.041	808.3	1367.0	63.04	14.13	24.84	686.0	1.01860
72.0	5.932	2.943	839.3	1417.0	63.74	14.37	24.91	694.2	1.01799
74.0	5.747	2.851	870.6	1467.0	64.43	14.62	25.01	702.1	1.01743
76.0	5.574	2.765	902.3	1517.0	65.10	14.88	25.15	709.6	1.01690
78.0	5.413	2.685	934.4	1568.0	65.75	15.17	25.31	716.8	1.01640
80.0	5.261	2.610	966.9	1618.0	66.40	15.46	25.49	723.8	1.01594
85.0	4.919	2.440	1050.0	1747.0	67.96	16.24	26.04	740.3	1.01490
90.0	4.621	2.292	1137.0	1879.0	69.46	17.08	26.68	755.8	1.01399
95.0	4.360	2.163	1228.0	2014.0	70.92	17.94	27.39	770.6	1.01320
100.0	4.128	2.048	1323.0	2153.0	72.35	18.81	28.13	785.0	1.01250
105.0	3.921	1.945	1421.0	2295.0	73.74	19.66	28.87	799.0	1.01187
110.0	3.735	1.853	1524.0	2442.0	75.10	20.48	29.60	813.0	1.01130
115.0	3.566	1.769	1630.0	2591.0	76.43	21.24	30.28	826.9	1.01079
120.0	3.413	1.693	1740.0	2744.0	77.73	21.94	30.91	840.9	1.01032

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
125.0	3.272	1.623	1853.0	2900.0	79.00	22.55	31.46	855.0	1.00990
130.0	3.143	1.559	1968.0	3059.0	80.25	23.08	31.94	869.1	1.00950
135.0	3.025	1.500	2086.0	3219.0	81.46	23.53	32.34	883.4	1.00914
140.0	2.915	1.446	2206.0	3382.0	82.64	23.92	32.68	897.6	1.00881
150.0	2.718	1.348	2450.0	3711.0	84.92	24.44	33.13	926.2	1.00821
160.0	2.546	1.263	2698.0	4044.0	87.06	24.70	33.34	955.0	1.00769
170.0	2.396	1.188	2947.0	4377.0	89.08	24.75	33.34	983.8	1.00724
180.0	2.262	1.122	3195.0	4710.0	90.99	24.64	33.19	1012.0	1.00683
190.0	2.143	1.063	3442.0	5041.0	92.77	24.42	32.94	1041.0	1.00647
200.0	2.036	1.010	3686.0	5369.0	94.46	24.14	32.64	1069.0	1.00615
210.0	1.939	.9619	3926.0	5694.0	96.04	23.82	32.30	1097.0	1.00586
220.0	1.851	.9183	4164.0	6015.0	97.53	23.50	31.96	1124.0	1.00559
230.0	1.771	.8786	4398.0	6333.0	98.95	23.19	31.63	1151.0	1.00535
240.0	1.698	.8421	4629.0	6647.0	100.3	22.89	31.31	1177.0	1.00513
250.0	1.630	.8086	4857.0	6959.0	101.6	22.61	31.03	1203.0	1.00492
260.0	1.568	.7777	5082.0	7268.0	102.8	22.37	30.77	1228.0	1.00473
270.0	1.510	.7491	5305.0	7575.0	103.9	22.15	30.54	1253.0	1.00456
280.0	1.456	.7225	5526.0	7879.0	105.0	21.95	30.34	1277.0	1.00440
300.0	1.360	.6746	5962.0	8482.0	107.1	21.65	30.02	1323.0	1.00410
320.0	1.276	.6327	6394.0	9080.0	109.0	21.43	29.79	1368.0	1.00385
340.0	1.201	.5958	6821.0	9674.0	110.8	21.27	29.62	1411.0	1.00362
360.0	1.135	.5629	7245.0	10270.0	112.5	21.17	29.51	1452.0	1.00342
380.0	1.075	.5335	7668.0	10850.0	114.1	21.09	29.43	1491.0	1.00325
400.0	1.022	.5070	8090.0	11440.0	115.6	21.04	29.37	1530.0	1.00308

1.80 MPa isobar

14.39*	77.91	38.65	-620.2	-573.6	10.15	10.88	14.33	1331.0	1.25471
15.0	77.46	38.42	-611.9	-565.0	10.74	10.32	13.94	1316.0	1.25313
16.0	76.70	38.04	-598.4	-551.1	11.64	10.10	14.12	1291.0	1.25043
18.0	75.04	37.22	-569.7	-521.3	13.39	10.65	15.74	1240.0	1.24463
20.0	73.20	36.31	-537.4	-487.8	15.15	11.38	17.82	1190.0	1.23819
22.0	71.14	35.29	-501.0	-450.0	16.95	11.95	20.03	1138.0	1.23100
24.0	68.81	34.13	-460.3	-407.5	18.80	12.36	22.45	1080.0	1.22292
26.0	66.15	32.81	-414.8	-359.9	20.70	12.65	25.30	1014.0	1.21372
27.0	64.66	32.07	-389.9	-333.8	21.69	12.78	27.01	977.2	1.20858
28.0	63.03	31.26	-363.4	-305.8	22.71	12.89	29.02	937.0	1.20299
29.0	61.23	30.37	-334.8	-275.6	23.77	13.00	31.48	893.0	1.19684
30.0	59.21	29.37	-303.9	-242.6	24.88	13.13	34.62	844.3	1.18997
31.0	56.90	28.23	-269.7	-206.0	26.08	13.28	38.88	789.8	1.18213
31.5	55.60	27.58	-251.1	-185.8	26.73	13.38	41.70	759.9	1.17772
32.0	54.17	26.87	-231.1	-164.2	27.41	13.49	45.23	727.9	1.17288
32.5	52.56	26.07	-209.5	-140.4	28.15	13.62	49.83	693.3	1.16748
33.0	50.73	25.17	-185.6	-114.0	28.95	13.80	56.14	655.8	1.16135
33.5	48.59	24.10	-158.5	-83.8	29.86	14.02	65.41	614.7	1.15417
34.0	45.95	22.79	-126.7	-47.7	30.93	14.32	80.26	569.5	1.14542
34.2	44.70	22.17	-112.0	-30.8	31.43	14.47	88.86	550.3	1.14127
34.4	43.30	21.48	-95.8	-12.0	31.97	14.64	99.69	530.5	1.13663
34.6	41.71	20.69	-77.8	9.2	32.59	14.84	113.2	510.7	1.13140
34.8	39.90	19.79	-57.5	33.4	33.29	15.05	129.1	491.4	1.12547
35.0	37.88	18.79	-34.9	60.9	34.07	15.28	145.5	473.9	1.11886
35.2	35.70	17.71	-10.3	91.3	34.94	15.48	157.9	459.5	1.11175
35.4	33.48	16.61	15.1	123.5	35.85	15.63	162.2	449.2	1.10458
35.6	31.39	15.57	40.0	155.6	36.76	15.71	157.9	443.0	1.09782
35.8	29.50	14.63	63.3	186.3	37.62	15.70	148.1	439.9	1.09176
36.0	27.86	13.82	84.5	214.7	38.41	15.64	136.1	438.9	1.08650
36.2	26.44	13.12	103.5	240.7	39.13	15.54	124.0	439.4	1.08198
36.4	25.23	12.51	120.6	264.4	39.78	15.42	113.0	440.7	1.07810
36.6	24.17	11.99	135.9	286.0	40.37	15.29	103.2	442.5	1.07476
36.8	23.26	11.54	149.8	305.8	40.91	15.16	94.90	444.7	1.07185
37.0	22.45	11.14	162.4	324.1	41.41	15.04	87.79	447.1	1.06930
37.2	21.73	10.78	174.0	341.0	41.86	14.91	81.73	449.6	1.06704
37.4	21.09	10.46	184.8	356.8	42.29	14.80	76.54	452.1	1.06502

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
37.6	20.52	10.18	194.8	371.7	42.68	14.69	72.08	454.8	1.06320
37.8	19.99	9.916	204.2	385.7	43.06	14.58	68.22	457.4	1.06155
38.0	19.51	9.678	213.0	399.0	43.41	14.48	64.85	460.0	1.06004
38.5	18.47	9.160	233.1	429.6	44.21	14.26	58.08	466.5	1.05676
39.0	17.59	8.727	251.1	457.4	44.92	14.07	53.02	472.8	1.05403
39.5	16.85	8.357	267.5	482.8	45.57	13.91	49.10	479.0	1.05170
40.0	16.20	8.034	282.5	506.6	46.17	13.78	46.00	484.8	1.04966
40.5	15.62	7.749	296.6	528.9	46.73	13.66	43.47	490.5	1.04787
41.0	15.11	7.493	309.9	550.1	47.25	13.56	41.39	496.0	1.04627
41.5	14.64	7.263	322.5	570.4	47.74	13.47	39.64	501.3	1.04482
42.0	14.22	7.053	334.6	589.8	48.20	13.39	38.15	506.5	1.04350
43.0	13.47	6.682	357.3	626.7	49.07	13.27	35.76	516.5	1.04119
44.0	12.83	6.364	378.7	661.5	49.87	13.17	33.92	525.9	1.03920
45.0	12.27	6.085	398.9	694.7	50.62	13.10	32.47	535.0	1.03746
46.0	11.77	5.838	418.2	726.5	51.32	13.05	31.30	543.6	1.03592
47.0	11.32	5.617	436.9	757.3	51.98	13.01	30.34	552.0	1.03454
48.0	10.92	5.416	454.9	787.3	52.61	12.98	29.53	560.0	1.03329
49.0	10.55	5.234	472.5	816.5	53.21	12.96	28.86	567.7	1.03216
50.0	10.21	5.067	489.8	845.0	53.79	12.96	28.28	575.2	1.03112
52.0	9.615	4.770	523.2	900.6	54.88	12.97	27.36	589.5	1.02928
54.0	9.097	4.513	555.7	954.6	55.90	13.00	26.66	603.0	1.02768
56.0	8.643	4.287	587.5	1007.0	56.86	13.07	26.14	615.6	1.02629
58.0	8.239	4.087	618.8	1059.0	57.77	13.15	25.74	627.5	1.02505
60.0	7.878	3.908	649.8	1110.0	58.63	13.27	25.44	638.8	1.02394
62.0	7.552	3.746	680.5	1161.0	59.46	13.40	25.23	649.5	1.02294
64.0	7.255	3.599	711.2	1211.0	60.26	13.55	25.09	659.5	1.02203
66.0	6.984	3.465	741.9	1261.0	61.03	13.73	25.01	669.1	1.02120
68.0	6.735	3.341	772.7	1311.0	61.78	13.93	24.98	678.2	1.02044
70.0	6.506	3.227	803.6	1361.0	62.50	14.14	25.00	686.8	1.01974
72.0	6.293	3.121	834.8	1411.0	63.21	14.38	25.05	695.0	1.01909
74.0	6.095	3.023	866.3	1462.0	63.90	14.63	25.15	702.9	1.01849
76.0	5.910	2.932	898.1	1512.0	64.57	14.89	25.27	710.4	1.01792
78.0	5.738	2.846	930.3	1563.0	65.23	15.17	25.42	717.7	1.01740
80.0	5.576	2.766	963.0	1614.0	65.87	15.47	25.60	724.7	1.01690
85.0	5.211	2.585	1047.0	1743.0	67.44	16.25	26.13	741.2	1.01579
90.0	4.895	2.428	1134.0	1875.0	68.95	17.08	26.77	756.7	1.01483
95.0	4.617	2.290	1225.0	2011.0	70.42	17.95	27.46	771.5	1.01398
100.0	4.371	2.168	1320.0	2150.0	71.84	18.81	28.19	785.8	1.01323
105.0	4.151	2.059	1419.0	2293.0	73.24	19.67	28.93	799.9	1.01256
110.0	3.953	1.961	1521.0	2439.0	74.60	20.49	29.65	813.9	1.01196
115.0	3.775	1.872	1628.0	2589.0	75.93	21.25	30.33	827.8	1.01142
120.0	3.612	1.792	1738.0	2742.0	77.24	21.95	30.95	841.8	1.01093
125.0	3.463	1.718	1851.0	2899.0	78.51	22.56	31.50	855.9	1.01047
130.0	3.326	1.650	1966.0	3057.0	79.76	23.09	31.97	870.0	1.01006
135.0	3.201	1.588	2084.0	3218.0	80.97	23.53	32.37	884.3	1.00968
140.0	3.084	1.530	2204.0	3381.0	82.16	23.92	32.71	898.5	1.00932
150.0	2.876	1.426	2449.0	3710.0	84.43	24.44	33.16	927.2	1.00869
160.0	2.694	1.337	2696.0	4043.0	86.58	24.70	33.36	955.9	1.00814
170.0	2.535	1.257	2946.0	4377.0	88.60	24.75	33.36	984.7	1.00766
180.0	2.394	1.187	3194.0	4710.0	90.50	24.64	33.21	1013.0	1.00723
190.0	2.267	1.125	3441.0	5041.0	92.29	24.42	32.96	1042.0	1.00685
200.0	2.154	1.069	3684.0	5369.0	93.98	24.14	32.65	1070.0	1.00651
210.0	2.052	1.018	3925.0	5694.0	95.56	23.83	32.31	1098.0	1.00620
220.0	1.959	.9717	4163.0	6015.0	97.06	23.51	31.97	1125.0	1.00592
230.0	1.874	.9296	4397.0	6333.0	98.47	23.19	31.64	1152.0	1.00566
240.0	1.796	.8911	4628.0	6648.0	99.81	22.89	31.32	1178.0	1.00542
250.0	1.725	.8556	4856.0	6960.0	101.1	22.62	31.03	1204.0	1.00521
260.0	1.659	.8229	5081.0	7269.0	102.3	22.37	30.78	1229.0	1.00501
270.0	1.598	.7926	5304.0	7575.0	103.5	22.15	30.55	1254.0	1.00482
280.0	1.541	.7645	5525.0	7880.0	104.6	21.96	30.35	1278.0	1.00465
300.0	1.439	.7139	5962.0	8483.0	106.6	21.65	30.02	1324.0	1.00434
320.0	1.350	.6696	6393.0	9081.0	108.6	21.43	29.79	1369.0	1.00407
340.0	1.271	.6305	6820.0	9675.0	110.4	21.27	29.63	1411.0	1.00384

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
360.0	1.201	.5957	7245.0	10270.0	112.1	21.17	29.51	1452.0	1.00362
380.0	1.138	.5646	7668.0	10860.0	113.7	21.09	29.43	1492.0	1.00343
400.0	1.082	.5366	8090.0	11440.0	115.2	21.04	29.38	1531.0	1.00326
1.90 MPa isobar									
14.42 ^a	77.96	38.67	-620.0	-570.9	10.16	10.87	14.27	1330.0	1.25489
15.0	77.54	38.46	-612.2	-562.8	10.71	10.34	13.92	1317.0	1.25340
16.0	76.78	38.09	-598.7	-548.9	11.61	10.11	14.09	1293.0	1.25073
18.0	75.14	37.27	-570.2	-519.2	13.36	10.66	15.70	1243.0	1.24497
20.0	73.31	36.37	-538.0	-485.8	15.11	11.38	17.76	1194.0	1.23857
22.0	71.27	35.35	-501.8	-448.1	16.91	11.95	19.95	1143.0	1.23145
24.0	68.97	34.21	-461.4	-405.9	18.74	12.36	22.32	1086.0	1.22345
26.0	66.34	32.91	-416.3	-358.6	20.64	12.65	25.09	1022.0	1.21438
27.0	64.87	32.18	-391.7	-332.7	21.61	12.77	26.74	986.0	1.20933
28.0	63.28	31.39	-365.5	-305.0	22.62	12.88	28.67	947.0	1.20386
29.0	61.53	30.52	-337.4	-275.2	23.67	12.99	30.98	904.4	1.19786
30.0	59.58	29.55	-307.1	-242.8	24.76	13.10	33.89	857.5	1.19120
31.0	57.36	28.45	-273.9	-207.1	25.93	13.24	37.73	805.5	1.18367
31.5	56.12	27.84	-255.9	-187.6	26.56	13.33	40.21	777.3	1.17947
32.0	54.77	27.17	-236.7	-166.8	27.21	13.42	43.22	747.2	1.17491
32.5	53.28	26.43	-216.2	-144.3	27.91	13.54	47.02	715.0	1.16990
33.0	51.61	25.60	-193.8	-119.6	28.66	13.68	51.99	680.5	1.16430
33.5	49.71	24.66	-169.0	-92.0	29.49	13.86	58.80	643.3	1.15792
34.0	47.47	23.55	-141.0	-60.3	30.43	14.09	68.69	603.0	1.15045
34.5	44.74	22.19	-108.0	-22.4	31.54	14.39	83.90	559.8	1.14139
34.7	43.46	21.56	-93.0	-4.8	32.05	14.53	92.19	542.1	1.13716
34.8	42.77	21.21	-85.0	4.6	32.32	14.61	96.88	533.2	1.13489
35.0	41.28	20.48	-67.8	25.0	32.90	14.78	107.3	515.7	1.12999
35.2	39.64	19.66	-49.0	47.6	33.55	14.96	118.5	499.1	1.12463
35.4	37.87	18.79	-28.8	72.4	34.25	15.13	129.1	484.2	1.11884
35.6	36.01	17.86	-7.3	99.0	35.00	15.29	136.8	471.9	1.11278
35.8	34.14	16.94	14.6	126.8	35.78	15.41	140.0	462.6	1.10671
36.0	32.34	16.04	36.3	154.7	36.56	15.48	138.4	456.3	1.10089
36.2	30.67	15.21	57.0	181.9	37.31	15.49	133.0	452.5	1.09550
36.4	29.16	14.46	76.4	207.8	38.02	15.46	125.6	450.6	1.09065
36.6	27.81	13.79	94.4	232.1	38.69	15.40	117.4	450.0	1.08634
36.8	26.61	13.20	110.8	254.7	39.30	15.31	109.2	450.5	1.08252
37.0	25.56	12.68	125.9	275.8	39.88	15.21	101.4	451.6	1.07916
37.2	24.62	12.21	139.8	295.4	40.40	15.10	94.45	453.1	1.07618
37.4	23.78	11.80	152.6	313.6	40.89	14.99	88.21	454.9	1.07353
37.6	23.03	11.43	164.4	330.7	41.35	14.89	82.70	457.0	1.07115
37.8	22.36	11.09	175.4	346.7	41.77	14.78	77.84	459.2	1.06902
38.0	21.75	10.79	185.7	361.9	42.17	14.68	73.58	461.4	1.06708
38.2	21.19	10.51	195.4	376.2	42.55	14.58	69.81	463.8	1.06531
38.4	20.67	10.25	204.6	389.8	42.90	14.49	66.48	466.2	1.06370
39.0	19.35	9.600	229.3	427.2	43.87	14.24	58.53	473.3	1.05955
39.5	18.45	9.150	247.5	455.2	44.58	14.06	53.61	479.3	1.05670
40.0	17.67	8.763	264.2	481.0	45.23	13.91	49.75	485.0	1.05426
40.5	16.99	8.426	279.6	505.1	45.83	13.78	46.65	490.6	1.05213
41.0	16.38	8.126	293.9	527.7	46.39	13.66	44.11	496.1	1.05024
41.5	15.84	7.859	307.5	549.2	46.91	13.56	42.00	501.4	1.04856
42.0	15.35	7.616	320.3	569.8	47.40	13.48	40.22	506.6	1.04704
43.0	14.50	7.193	344.4	608.5	48.31	13.34	37.40	516.6	1.04439
44.0	13.78	6.833	366.8	644.8	49.15	13.23	35.26	526.1	1.04213
45.0	13.15	6.521	387.8	679.2	49.92	13.15	33.58	535.2	1.04018
46.0	12.59	6.246	407.9	712.1	50.64	13.09	32.25	543.9	1.03846
47.0	12.10	6.001	427.1	743.8	51.32	13.04	31.15	552.3	1.03693
48.0	11.65	5.780	445.7	774.5	51.97	13.01	30.25	560.4	1.03556
49.0	11.25	5.580	463.8	804.3	52.59	12.99	29.49	568.2	1.03431
50.0	10.88	5.397	481.4	833.5	53.17	12.98	28.84	575.7	1.03317
52.0	10.23	5.073	515.5	890.1	54.28	12.98	27.82	590.1	1.03116

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C, J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
54.0	9.664	4.794	548.6	944.9	55.32	13.02	27.05	603.5	1.02943
56.0	9.173	4.550	580.8	998.4	56.29	13.08	26.47	616.2	1.02791
58.0	8.738	4.334	612.5	1051.0	57.21	13.17	26.03	628.2	1.02658
60.0	8.350	4.142	643.8	1103.0	58.09	13.28	25.70	639.5	1.02539
62.0	7.999	3.968	674.9	1154.0	58.93	13.41	25.46	650.2	1.02431
64.0	7.682	3.811	705.9	1204.0	59.73	13.56	25.30	660.3	1.02334
66.0	7.392	3.667	736.8	1255.0	60.51	13.74	25.20	669.9	1.02245
68.0	7.126	3.535	767.8	1305.0	61.26	13.93	25.15	679.0	1.02164
70.0	6.881	3.413	798.9	1356.0	61.99	14.15	25.15	687.6	1.02089
72.0	6.654	3.301	830.3	1406.0	62.70	14.38	25.20	695.9	1.02019
74.0	6.443	3.196	861.9	1456.0	63.39	14.63	25.28	703.7	1.01955
76.0	6.247	3.099	893.9	1507.0	64.07	14.90	25.39	711.3	1.01895
78.0	6.063	3.008	926.3	1558.0	64.73	15.18	25.54	718.5	1.01839
80.0	5.891	2.922	959.1	1609.0	65.38	15.47	25.71	725.5	1.01786
85.0	5.504	2.730	1043.0	1739.0	66.95	16.26	26.23	742.1	1.01668
90.0	5.169	2.564	1131.0	1872.0	68.47	17.09	26.85	757.6	1.01566
95.0	4.874	2.418	1222.0	2008.0	69.94	17.95	27.54	772.4	1.01476
100.0	4.614	2.289	1317.0	2147.0	71.37	18.82	28.26	786.7	1.01397
105.0	4.381	2.173	1416.0	2290.0	72.76	19.67	28.99	800.8	1.01326
110.0	4.172	2.069	1519.0	2437.0	74.13	20.49	29.70	814.8	1.01263
115.0	3.983	1.976	1625.0	2587.0	75.46	21.26	30.38	828.7	1.01205
120.0	3.811	1.890	1735.0	2741.0	76.77	21.95	30.99	842.7	1.01153
125.0	3.654	1.812	1849.0	2897.0	78.05	22.57	31.54	856.8	1.01105
130.0	3.509	1.741	1964.0	3056.0	79.29	23.09	32.01	871.0	1.01061
135.0	3.376	1.675	2082.0	3217.0	80.51	23.54	32.40	885.2	1.01021
140.0	3.253	1.614	2203.0	3380.0	81.69	23.93	32.74	899.4	1.00984
150.0	3.033	1.505	2447.0	3710.0	83.97	24.45	33.19	928.1	1.00917
160.0	2.842	1.410	2695.0	4043.0	86.12	24.71	33.38	956.9	1.00859
170.0	2.674	1.326	2944.0	4377.0	88.14	24.75	33.38	985.6	1.00808
180.0	2.525	1.252	3193.0	4710.0	90.05	24.64	33.23	1014.0	1.00763
190.0	2.392	1.186	3439.0	5041.0	91.84	24.43	32.98	1043.0	1.00723
200.0	2.272	1.127	3683.0	5369.0	93.52	24.15	32.66	1071.0	1.00686
210.0	2.164	1.074	3924.0	5694.0	95.11	23.83	32.33	1099.0	1.00654
220.0	2.066	1.025	4162.0	6016.0	96.60	23.51	31.98	1126.0	1.00624
230.0	1.977	.9806	4396.0	6334.0	98.02	23.19	31.65	1153.0	1.00597
240.0	1.895	.9399	4627.0	6649.0	99.36	22.89	31.33	1179.0	1.00572
250.0	1.819	.9025	4855.0	6960.0	100.6	22.62	31.04	1205.0	1.00549
260.0	1.750	.8680	5081.0	7270.0	101.8	22.37	30.78	1230.0	1.00528
270.0	1.686	.8361	5304.0	7576.0	103.0	22.15	30.55	1255.0	1.00509
280.0	1.626	.8065	5525.0	7881.0	104.1	21.96	30.35	1279.0	1.00491
300.0	1.518	.7531	5961.0	8484.0	106.2	21.65	30.03	1325.0	1.00458
320.0	1.424	.7064	6393.0	9082.0	108.1	21.43	29.80	1369.0	1.00430
340.0	1.341	.6651	6820.0	9677.0	109.9	21.28	29.63	1412.0	1.00405
360.0	1.267	.6285	7245.0	10270.0	111.6	21.17	29.52	1453.0	1.00382
380.0	1.201	.5957	7668.0	10860.0	113.2	21.10	29.44	1493.0	1.00362
400.0	1.141	.5661	8089.0	11450.0	114.7	21.04	29.38	1532.0	1.00344

2.00 MPa isobar

14.46*	78.01	38.70	-619.9	-568.2	10.17	10.86	14.22	1329.0	1.25507
15.0	77.62	38.50	-612.5	-560.6	10.69	10.36	13.90	1317.0	1.25368
16.0	76.86	38.13	-599.1	-546.7	11.59	10.13	14.06	1294.0	1.25102
18.0	75.23	37.32	-570.7	-517.1	13.32	10.66	15.66	1246.0	1.24530
20.0	73.42	36.42	-538.7	-483.8	15.08	11.38	17.70	1198.0	1.23895
22.0	71.39	35.41	-502.7	-446.2	16.87	11.95	19.86	1148.0	1.23189
24.0	69.12	34.29	-462.5	-404.2	18.69	12.35	22.20	1093.0	1.22398
26.0	66.53	33.00	-417.8	-357.2	20.57	12.64	24.90	1030.0	1.21503
27.0	65.09	32.29	-393.4	-331.5	21.54	12.76	26.49	994.6	1.21006
28.0	63.52	31.51	-367.6	-304.1	22.54	12.86	28.33	956.6	1.20469
29.0	61.81	30.66	-339.9	-274.7	23.57	12.97	30.53	915.4	1.19884
30.0	59.92	29.72	-310.2	-242.9	24.65	13.08	33.23	870.2	1.19237
31.0	57.78	28.66	-277.8	-208.0	25.79	13.21	36.73	820.4	1.18511

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
31.5	56.60	28.08	-260.3	-189.1	26.40	13.28	38.93	793.5	1.18110
32.0	55.32	27.44	-241.9	-169.0	27.03	13.37	41.56	765.1	1.17678
32.5	53.93	26.75	-222.2	-147.4	27.70	13.47	44.78	734.9	1.17207
33.0	52.39	25.99	-201.0	-124.1	28.41	13.59	48.84	702.8	1.16689
33.5	50.66	25.13	-178.0	-98.4	29.18	13.73	54.14	668.6	1.16110
34.0	48.68	24.15	-152.4	-69.6	30.04	13.91	61.34	632.0	1.15450
34.5	46.37	23.00	-123.5	-36.5	31.00	14.14	71.54	593.1	1.14680
35.0	43.58	21.62	-89.8	2.7	32.13	14.44	86.26	552.8	1.13757
35.2	42.30	20.98	-74.7	20.7	32.64	14.57	93.62	536.8	1.13335
35.4	40.91	20.30	-58.4	40.2	33.20	14.71	101.6	521.4	1.12879
35.6	39.43	19.56	-41.0	61.3	33.79	14.86	109.6	507.0	1.12392
36.0	36.23	17.97	-3.4	107.8	35.09	15.12	121.8	483.4	1.11350
36.5	32.28	16.01	44.6	169.5	36.79	15.29	122.0	466.6	1.10069
36.7	30.84	15.30	62.8	193.5	37.45	15.29	118.0	463.4	1.09607
36.8	30.17	14.97	71.6	205.2	37.77	15.28	115.4	462.3	1.09391
37.0	28.91	14.34	88.3	227.7	38.38	15.24	109.8	461.1	1.08987
37.2	27.77	13.78	103.9	249.1	38.95	15.18	103.8	460.9	1.08622
37.4	26.74	13.27	118.5	269.3	39.49	15.10	97.88	461.3	1.08293
37.6	25.81	12.80	132.1	288.3	40.00	15.01	92.24	462.2	1.07997
37.8	24.97	12.39	144.7	306.2	40.47	14.92	87.00	463.6	1.07730
38.0	24.21	12.01	156.6	323.1	40.92	14.83	82.22	465.1	1.07487
38.2	23.51	11.66	167.6	339.1	41.34	14.74	77.89	466.9	1.07267
38.4	22.88	11.35	178.1	354.3	41.74	14.64	73.98	468.8	1.07066
38.6	22.30	11.06	187.9	368.7	42.11	14.56	70.47	470.9	1.06882
39.0	21.26	10.55	206.1	395.7	42.81	14.39	64.47	475.1	1.06556
39.5	20.17	10.00	226.4	426.4	43.59	14.20	58.51	480.6	1.06211
40.0	19.24	9.543	244.8	454.4	44.29	14.04	53.84	486.0	1.05919
40.5	18.44	9.145	261.6	480.3	44.94	13.89	50.10	491.5	1.05667
41.0	17.73	8.795	277.2	504.6	45.53	13.77	47.07	496.8	1.05446
41.5	17.11	8.485	291.8	527.5	46.09	13.66	44.56	502.1	1.05250
42.0	16.54	8.207	305.5	549.2	46.61	13.56	42.46	507.2	1.05075
42.5	16.04	7.955	318.6	570.0	47.10	13.48	40.68	512.2	1.04916
43.0	15.57	7.725	331.1	590.0	47.57	13.41	39.15	517.1	1.04772
44.0	14.75	7.319	354.6	627.8	48.44	13.29	36.67	526.6	1.04517
45.0	14.05	6.970	376.5	663.5	49.24	13.20	34.76	535.7	1.04298
46.0	13.43	6.664	397.4	697.5	49.99	13.13	33.24	544.4	1.04107
47.0	12.89	6.394	417.3	730.1	50.69	13.08	32.01	552.8	1.03938
48.0	12.40	6.151	436.4	761.5	51.35	13.04	30.99	560.9	1.03787
49.0	11.96	5.932	454.9	792.1	51.98	13.02	30.14	568.7	1.03650
50.0	11.56	5.732	473.0	821.9	52.58	13.00	29.43	576.3	1.03526
52.0	10.85	5.380	507.8	879.5	53.71	13.00	28.29	590.7	1.03307
54.0	10.24	5.078	541.4	935.2	54.76	13.03	27.44	604.2	1.03119
56.0	9.708	4.816	574.1	989.4	55.75	13.09	26.80	617.0	1.02956
58.0	9.241	4.584	606.2	1043.0	56.68	13.18	26.32	629.0	1.02812
60.0	8.824	4.377	637.9	1095.0	57.57	13.29	25.95	640.3	1.02684
62.0	8.450	4.192	669.3	1146.0	58.41	13.42	25.69	651.0	1.02569
64.0	8.111	4.023	700.5	1198.0	59.23	13.57	25.50	661.1	1.02465
66.0	7.802	3.870	731.7	1248.0	60.01	13.75	25.38	670.7	1.02371
68.0	7.518	3.729	762.9	1299.0	60.77	13.94	25.32	679.8	1.02284
70.0	7.257	3.600	794.2	1350.0	61.50	14.16	25.31	688.5	1.02204
72.0	7.016	3.480	825.8	1400.0	62.21	14.39	25.34	696.7	1.02130
74.0	6.793	3.369	857.6	1451.0	62.91	14.64	25.41	704.6	1.02062
76.0	6.584	3.266	889.7	1502.0	63.59	14.91	25.52	712.2	1.01998
78.0	6.389	3.169	922.2	1553.0	64.25	15.19	25.65	719.4	1.01939
80.0	6.207	3.079	955.2	1605.0	64.90	15.48	25.82	726.4	1.01883
85.0	5.797	2.876	1040.0	1735.0	66.48	16.27	26.32	742.9	1.01758
90.0	5.442	2.700	1127.0	1868.0	68.00	17.10	26.93	758.5	1.01650
95.0	5.131	2.545	1219.0	2004.0	69.48	17.96	27.61	773.3	1.01555
100.0	4.856	2.409	1314.0	2144.0	70.91	18.83	28.32	787.6	1.01471
105.0	4.611	2.287	1413.0	2288.0	72.31	19.68	29.04	801.7	1.01396
110.0	4.390	2.178	1516.0	2435.0	73.68	20.50	29.75	815.7	1.01329
115.0	4.191	2.079	1623.0	2585.0	75.02	21.26	30.42	829.6	1.01268
120.0	4.009	1.989	1733.0	2739.0	76.32	21.96	31.04	843.6	1.01213

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
125.0	3.844	1.907	1846.0	2895.0	77.60	22.57	31.58	857.7	1.01163
130.0	3.692	1.831	1962.0	3054.0	78.85	23.10	32.04	871.9	1.01117
135.0	3.552	1.762	2081.0	3216.0	80.07	23.55	32.44	886.1	1.01074
140.0	3.423	1.698	2201.0	3379.0	81.25	23.93	32.77	900.3	1.01035
150.0	3.191	1.583	2445.0	3709.0	83.53	24.45	33.21	929.0	1.00965
160.0	2.989	1.483	2693.0	4042.0	85.68	24.71	33.41	957.8	1.00904
170.0	2.812	1.395	2943.0	4376.0	87.71	24.76	33.40	986.6	1.00850
180.0	2.656	1.317	3191.0	4710.0	89.61	24.65	33.24	1015.0	1.00803
190.0	2.516	1.248	3438.0	5041.0	91.40	24.43	32.99	1044.0	1.00760
200.0	2.390	1.186	3682.0	5369.0	93.09	24.15	32.68	1072.0	1.00722
210.0	2.277	1.129	3923.0	5694.0	94.68	23.84	32.34	1100.0	1.00688
220.0	2.173	1.078	4161.0	6016.0	96.17	23.51	31.99	1127.0	1.00656
230.0	2.079	1.031	4395.0	6334.0	97.59	23.20	31.66	1154.0	1.00628
240.0	1.993	.9887	4626.0	6649.0	98.93	22.90	31.34	1180.0	1.00602
250.0	1.914	.9494	4855.0	6961.0	100.2	22.62	31.05	1206.0	1.00578
260.0	1.841	.9131	5080.0	7270.0	101.4	22.37	30.79	1231.0	1.00556
270.0	1.773	.8796	5303.0	7577.0	102.6	22.15	30.56	1255.0	1.00535
280.0	1.710	.8484	5524.0	7882.0	103.7	21.96	30.36	1279.0	1.00516
300.0	1.597	.7922	5961.0	8485.0	105.8	21.65	30.03	1326.0	1.00482
320.0	1.498	.7431	6392.0	9084.0	107.7	21.43	29.80	1370.0	1.00452
340.0	1.411	.6998	6820.0	9678.0	109.5	21.28	29.64	1413.0	1.00426
360.0	1.333	.6612	7245.0	10270.0	111.2	21.17	29.52	1454.0	1.00402
380.0	1.263	.6267	7668.0	10860.0	112.8	21.10	29.44	1494.0	1.00381
400.0	1.201	.5956	8089.0	11450.0	114.3	21.04	29.38	1532.0	1.00362

2.20 MPa isobar

14.52*	78.12	38.75	-619.6	-562.8	10.18	10.84	14.12	1328.0	1.25543
15.0	77.77	38.58	-613.1	-556.1	10.64	10.41	13.85	1318.0	1.25422
16.0	77.03	38.21	-599.8	-542.3	11.53	10.15	14.01	1297.0	1.25160
18.0	75.42	37.41	-571.6	-512.8	13.26	10.67	15.57	1252.0	1.24596
20.0	73.63	36.53	-539.9	-479.7	15.01	11.38	17.59	1206.0	1.23970
22.0	71.64	35.54	-504.3	-442.4	16.78	11.94	19.70	1158.0	1.23276
24.0	69.41	34.43	-464.7	-400.8	18.59	12.34	21.96	1105.0	1.22501
26.0	66.89	33.18	-420.7	-354.4	20.45	12.62	24.54	1044.0	1.21628
27.0	65.50	32.49	-396.8	-329.1	21.40	12.74	26.03	1011.0	1.21147
28.0	63.99	31.74	-371.5	-302.2	22.38	12.84	27.73	975.0	1.20630
29.0	62.36	30.93	-344.7	-273.5	23.39	12.94	29.71	936.1	1.20069
30.0	60.56	30.04	-315.9	-242.7	24.43	13.04	32.09	893.9	1.19456
31.0	58.57	29.05	-284.9	-209.2	25.53	13.15	35.06	848.0	1.18777
32.0	56.31	27.93	-251.0	-172.3	26.70	13.28	38.94	797.6	1.18012
32.5	55.06	27.31	-232.7	-152.2	27.32	13.35	41.39	770.6	1.17589
33.0	53.70	26.64	-213.4	-130.8	27.98	13.44	44.32	742.2	1.17132
33.5	52.22	25.90	-192.7	-107.8	28.67	13.55	47.91	712.3	1.16633
34.0	50.58	25.09	-170.4	-82.7	29.41	13.67	52.39	680.9	1.16084
34.5	48.75	24.18	-146.1	-55.2	30.22	13.82	58.13	648.0	1.15472
35.0	46.67	23.15	-119.3	-24.3	31.10	14.01	65.59	613.9	1.14780
35.5	44.28	21.96	-89.4	10.8	32.10	14.22	75.22	579.3	1.13988
36.0	41.53	20.60	-55.6	51.2	33.23	14.47	86.71	546.2	1.13081
36.5	38.44	19.07	-18.0	97.4	34.50	14.71	97.43	517.9	1.12070
37.0	35.22	17.47	21.8	147.7	35.87	14.89	102.5	497.8	1.11022
37.5	32.18	15.96	60.8	198.6	37.24	14.95	99.90	486.6	1.10038
37.7	31.07	15.41	75.6	218.3	37.76	14.94	97.30	484.1	1.09679
37.8	30.54	15.15	82.7	228.0	38.02	14.93	95.79	483.3	1.09509
38.0	29.53	14.65	96.6	246.8	38.52	14.90	92.50	482.1	1.09185
38.2	28.59	14.18	109.8	264.9	38.99	14.85	89.01	481.7	1.08885
38.4	27.73	13.75	122.4	282.4	39.45	14.79	85.47	481.7	1.08607
38.6	26.92	13.35	134.4	299.1	39.88	14.73	81.98	482.1	1.08350
38.8	26.17	12.98	145.8	315.2	40.30	14.66	78.61	482.9	1.08112
39.0	25.48	12.64	156.6	330.6	40.69	14.59	75.41	483.9	1.07892
39.5	23.96	11.89	181.4	366.5	41.61	14.42	68.26	487.4	1.07409
40.0	22.68	11.25	203.5	399.1	42.43	14.26	62.32	491.4	1.07003
40.5	21.59	10.71	223.5	429.0	43.17	14.10	57.43	495.8	1.06659

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
41.0	20.65	10.24	241.8	456.6	43.85	13.97	53.41	500.5	1.06361
41.5	19.82	9.831	258.7	482.5	44.48	13.84	50.08	505.2	1.06101
42.0	19.09	9.468	274.4	506.8	45.06	13.73	47.30	510.0	1.05871
42.5	18.43	9.143	289.2	529.8	45.60	13.64	44.94	514.7	1.05665
43.0	17.84	8.849	303.2	551.8	46.12	13.55	42.94	519.4	1.05480
43.5	17.30	8.583	316.5	572.8	46.60	13.47	41.22	524.1	1.05312
44.0	16.81	8.339	329.2	593.1	47.07	13.41	39.72	528.6	1.05158
45.0	15.94	7.906	353.2	631.5	47.93	13.30	37.27	537.6	1.04886
46.0	15.19	7.533	375.7	667.8	48.73	13.21	35.35	546.2	1.04651
47.0	14.53	7.206	397.0	702.3	49.47	13.15	33.81	554.5	1.04446
48.0	13.94	6.915	417.3	735.5	50.17	13.10	32.55	562.6	1.04264
49.0	13.41	6.654	436.9	767.5	50.83	13.07	31.51	570.4	1.04101
50.0	12.94	6.419	455.8	798.6	51.46	13.05	30.64	578.0	1.03954
51.0	12.51	6.204	474.2	828.8	52.06	13.04	29.90	585.3	1.03820
52.0	12.11	6.007	492.1	858.4	52.63	13.04	29.26	592.4	1.03697
54.0	11.40	5.657	526.9	915.8	53.72	13.06	28.25	605.9	1.03479
56.0	10.79	5.354	560.7	971.6	54.73	13.12	27.49	618.7	1.03290
58.0	10.26	5.089	593.6	1026.0	55.68	13.20	26.91	630.7	1.03125
60.0	9.784	4.853	626.0	1079.0	56.59	13.31	26.47	642.1	1.02979
62.0	9.358	4.642	658.0	1132.0	57.45	13.44	26.15	652.8	1.02848
64.0	8.974	4.452	689.7	1184.0	58.28	13.59	25.91	663.0	1.02731
66.0	8.626	4.279	721.4	1236.0	59.07	13.76	25.75	672.6	1.02623
68.0	8.307	4.121	753.1	1287.0	59.84	13.96	25.66	681.7	1.02526
70.0	8.014	3.975	784.8	1338.0	60.58	14.17	25.62	690.3	1.02436
72.0	7.744	3.841	816.8	1389.0	61.30	14.41	25.63	698.6	1.02353
74.0	7.493	3.717	848.9	1441.0	62.00	14.66	25.68	706.5	1.02276
76.0	7.260	3.601	881.4	1492.0	62.69	14.92	25.76	714.0	1.02205
78.0	7.043	3.494	914.2	1544.0	63.36	15.20	25.88	721.3	1.02138
80.0	6.840	3.393	947.4	1596.0	64.02	15.50	26.03	728.3	1.02076
85.0	6.384	3.167	1032.0	1727.0	65.61	16.28	26.51	744.8	1.01937
90.0	5.990	2.971	1121.0	1861.0	67.14	17.11	27.09	760.3	1.01817
95.0	5.645	2.800	1212.0	1998.0	68.62	17.97	27.75	775.1	1.01711
100.0	5.341	2.649	1308.0	2139.0	70.06	18.84	28.45	789.5	1.01619
105.0	5.070	2.515	1408.0	2283.0	71.47	19.69	29.16	803.6	1.01536
110.0	4.826	2.394	1511.0	2430.0	72.84	20.51	29.85	817.6	1.01462
115.0	4.606	2.285	1618.0	2581.0	74.18	21.27	30.52	831.5	1.01395
120.0	4.406	2.186	1729.0	2735.0	75.50	21.97	31.12	845.5	1.01334
125.0	4.224	2.095	1842.0	2892.0	76.78	22.58	31.66	859.6	1.01279
130.0	4.056	2.012	1958.0	3052.0	78.03	23.11	32.11	873.8	1.01228
135.0	3.902	1.936	2077.0	3213.0	79.25	23.56	32.50	888.0	1.01181
140.0	3.760	1.865	2197.0	3377.0	80.44	23.94	32.84	902.2	1.01138
150.0	3.505	1.739	2442.0	3707.0	82.72	24.46	33.26	930.9	1.01060
160.0	3.284	1.629	2690.0	4041.0	84.87	24.72	33.45	959.7	1.00993
170.0	3.089	1.532	2940.0	4376.0	86.90	24.77	33.44	988.4	1.00934
180.0	2.917	1.447	3189.0	4709.0	88.81	24.66	33.28	1017.0	1.00882
190.0	2.763	1.371	3436.0	5041.0	90.60	24.44	33.02	1046.0	1.00835
200.0	2.625	1.302	3680.0	5370.0	92.29	24.16	32.71	1074.0	1.00793
210.0	2.501	1.240	3921.0	5695.0	93.87	23.84	32.36	1101.0	1.00756
220.0	2.387	1.184	4159.0	6017.0	95.37	23.52	32.01	1129.0	1.00721
230.0	2.284	1.133	4394.0	6335.0	96.79	23.20	31.68	1156.0	1.00690
240.0	2.190	1.086	4625.0	6650.0	98.13	22.90	31.36	1182.0	1.00661
250.0	2.103	1.043	4853.0	6963.0	99.40	22.63	31.07	1207.0	1.00635
260.0	2.022	1.003	5079.0	7272.0	100.6	22.38	30.81	1233.0	1.00611
270.0	1.948	.9663	5302.0	7579.0	101.8	22.16	30.57	1257.0	1.00588
280.0	1.879	.9320	5523.0	7883.0	102.9	21.97	30.37	1281.0	1.00567
300.0	1.755	.8704	5960.0	8487.0	105.0	21.66	30.04	1328.0	1.00530
320.0	1.646	.8165	6391.0	9086.0	106.9	21.44	29.81	1372.0	1.00497
340.0	1.550	.7689	6819.0	9680.0	108.7	21.28	29.64	1415.0	1.00468
360.0	1.465	.7266	7244.0	10270.0	110.4	21.18	29.53	1456.0	1.00442
380.0	1.388	.6887	7667.0	10860.0	112.0	21.10	29.45	1495.0	1.00419
400.0	1.320	.6545	8089.0	11450.0	113.5	21.05	29.39	1534.0	1.00398

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
2.40 MPa isobar									
14.58*	78.22	38.80	-619.3	-557.4	10.20	10.81	14.03	1327.0	1.25580
15.0	77.92	38.65	-613.7	-551.7	10.59	10.44	13.80	1320.0	1.25476
16.0	77.19	38.29	-600.5	-537.8	11.48	10.17	13.95	1300.0	1.25217
18.0	75.60	37.50	-572.6	-508.6	13.20	10.67	15.49	1258.0	1.24661
20.0	73.84	36.63	-541.1	-475.6	14.94	11.37	17.48	1214.0	1.24044
22.0	71.89	35.66	-505.9	-438.6	16.70	11.93	19.55	1168.0	1.23360
24.0	69.70	34.57	-466.7	-397.3	18.49	12.33	21.74	1116.0	1.22600
26.0	67.24	33.35	-423.4	-351.4	20.33	12.61	24.21	1059.0	1.21749
28.0	64.43	31.96	-375.2	-300.2	22.23	12.82	27.19	992.4	1.20782
29.0	62.86	31.18	-349.0	-272.1	23.21	12.91	29.00	955.6	1.20243
30.0	61.15	30.34	-321.2	-242.0	24.23	13.00	31.13	915.9	1.19658
31.0	59.27	29.40	-291.3	-209.7	25.29	13.10	33.71	873.0	1.19017
32.0	57.18	28.36	-259.0	-174.4	26.41	13.21	36.95	826.6	1.18306
33.0	54.81	27.19	-223.7	-135.4	27.61	13.34	41.18	776.3	1.17504
34.0	52.06	25.83	-184.4	-91.5	28.92	13.51	47.02	721.7	1.16581
35.0	48.80	24.21	-139.7	-40.5	30.40	13.74	55.50	662.9	1.15488
35.5	46.90	23.26	-114.6	-11.4	31.23	13.89	61.19	632.5	1.14856
36.0	44.79	22.22	-87.2	20.9	32.13	14.06	68.01	602.2	1.14156
36.5	42.44	21.05	-57.3	56.7	33.12	14.24	75.64	573.3	1.13380
37.0	39.88	19.78	-24.9	96.4	34.20	14.42	82.88	547.7	1.12539
38.0	34.55	17.14	43.4	183.4	36.52	14.65	88.50	513.6	1.10805
38.5	32.10	15.92	76.4	227.1	37.66	14.66	85.64	505.6	1.10012
39.0	29.93	14.85	107.0	268.7	38.73	14.60	80.60	502.0	1.09312
39.5	28.04	13.91	135.0	307.6	39.72	14.50	74.82	501.4	1.08708
40.0	26.42	13.10	160.4	343.5	40.63	14.38	69.15	502.5	1.08190
40.5	25.02	12.41	183.4	376.8	41.45	14.25	63.99	504.9	1.07746
41.0	23.81	11.81	204.5	407.6	42.21	14.12	59.46	508.1	1.07362
41.5	22.76	11.29	223.8	436.4	42.91	13.99	55.56	511.7	1.07028
42.0	21.83	10.83	241.7	463.3	43.55	13.88	52.22	515.6	1.06734
42.5	21.00	10.42	258.3	488.7	44.15	13.77	49.36	519.7	1.06474
43.0	20.27	10.05	274.0	512.7	44.72	13.68	46.91	523.9	1.06241
43.5	19.60	9.722	288.8	535.6	45.25	13.60	44.79	528.2	1.06032
44.0	18.99	9.421	302.8	557.6	45.75	13.52	42.95	532.4	1.05841
45.0	17.93	8.893	329.1	598.9	46.68	13.40	39.93	540.9	1.05508
46.0	17.02	8.443	353.4	637.6	47.53	13.30	37.58	549.2	1.05224
47.0	16.23	8.052	376.2	674.2	48.32	13.22	35.71	557.3	1.04978
48.0	15.54	7.708	397.8	709.2	49.05	13.17	34.19	565.2	1.04761
49.0	14.92	7.401	418.4	742.7	49.74	13.12	32.94	572.9	1.04569
50.0	14.37	7.126	438.3	775.1	50.40	13.10	31.90	580.4	1.04396
51.0	13.86	6.877	457.5	806.6	51.02	13.08	31.02	587.6	1.04240
52.0	13.40	6.649	476.2	837.2	51.61	13.08	30.27	594.7	1.04098
54.0	12.59	6.247	512.3	896.5	52.73	13.09	29.08	608.1	1.03847
56.0	11.90	5.902	547.1	953.7	53.77	13.14	28.19	620.9	1.03631
58.0	11.29	5.601	580.9	1009.0	54.75	13.22	27.51	632.9	1.03444
60.0	10.75	5.335	614.0	1064.0	55.67	13.33	27.00	644.2	1.03278
62.0	10.28	5.097	646.6	1117.0	56.55	13.45	26.61	654.9	1.03131
64.0	9.846	4.884	679.0	1170.0	57.39	13.61	26.33	665.0	1.02998
66.0	9.456	4.691	711.2	1223.0	58.20	13.78	26.13	674.6	1.02879
68.0	9.100	4.514	743.3	1275.0	58.98	13.97	26.00	683.7	1.02769
70.0	8.774	4.353	775.5	1327.0	59.73	14.19	25.93	692.4	1.02669
72.0	8.474	4.204	807.8	1379.0	60.46	14.42	25.91	700.6	1.02577
74.0	8.196	4.066	840.3	1431.0	61.17	14.67	25.94	708.5	1.02492
76.0	7.939	3.938	873.0	1482.0	61.86	14.94	26.01	716.0	1.02413
78.0	7.698	3.819	906.1	1535.0	62.54	15.22	26.11	723.3	1.02339
80.0	7.474	3.707	939.6	1587.0	63.20	15.51	26.25	730.3	1.02270
85.0	6.971	3.458	1025.0	1719.0	64.81	16.29	26.69	746.8	1.02116
90.0	6.538	3.243	1114.0	1854.0	66.35	17.13	27.25	762.3	1.01984
95.0	6.159	3.055	1206.0	1992.0	67.84	17.99	27.89	777.1	1.01868
100.0	5.825	2.890	1302.0	2133.0	69.29	18.85	28.57	791.4	1.01766
105.0	5.528	2.742	1402.0	2278.0	70.70	19.71	29.27	805.5	1.01676
110.0	5.261	2.610	1506.0	2426.0	72.07	20.52	29.96	819.4	1.01594

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
115.0	5.020	2.490	1613.0	2577.0	73.42	21.29	30.61	833.4	1.01521
120.0	4.802	2.382	1724.0	2732.0	74.74	21.98	31.20	847.4	1.01454
125.0	4.603	2.283	1838.0	2889.0	76.02	22.59	31.73	861.5	1.01394
130.0	4.420	2.193	1954.0	3049.0	77.27	23.12	32.18	875.6	1.01338
135.0	4.252	2.109	2073.0	3211.0	78.50	23.57	32.57	889.9	1.01287
140.0	4.096	2.032	2193.0	3374.0	79.69	23.95	32.89	904.1	1.01240
150.0	3.819	1.894	2439.0	3706.0	81.97	24.47	33.32	932.8	1.01155
160.0	3.577	1.774	2687.0	4040.0	84.13	24.73	33.50	961.6	1.01082
170.0	3.365	1.669	2937.0	4375.0	86.16	24.78	33.48	990.3	1.01018
180.0	3.178	1.576	3186.0	4709.0	88.07	24.66	33.31	1019.0	1.00961
190.0	3.010	1.493	3434.0	5041.0	89.86	24.45	33.05	1047.0	1.00910
200.0	2.860	1.419	3678.0	5370.0	91.55	24.16	32.73	1076.0	1.00864
210.0	2.724	1.351	3919.0	5695.0	93.14	23.85	32.39	1103.0	1.00823
220.0	2.601	1.290	4157.0	6018.0	94.64	23.52	32.04	1131.0	1.00786
230.0	2.488	1.234	4392.0	6336.0	96.06	23.21	31.70	1157.0	1.00752
240.0	2.385	1.183	4623.0	6652.0	97.40	22.91	31.38	1184.0	1.00721
250.0	2.291	1.136	4852.0	6964.0	98.67	22.63	31.08	1209.0	1.00692
260.0	2.203	1.093	5077.0	7273.0	99.89	22.38	30.82	1234.0	1.00665
270.0	2.122	1.053	5301.0	7580.0	101.0	22.16	30.59	1259.0	1.00641
280.0	2.047	1.016	5522.0	7885.0	102.2	21.97	30.38	1283.0	1.00618
300.0	1.912	.9484	5959.0	8489.0	104.2	21.66	30.06	1329.0	1.00577
320.0	1.794	.8897	6391.0	9088.0	106.2	21.44	29.82	1374.0	1.00542
340.0	1.689	.8379	6818.0	9683.0	108.0	21.29	29.65	1416.0	1.00510
360.0	1.596	.7918	7243.0	10270.0	109.7	21.18	29.53	1457.0	1.00482
380.0	1.513	.7505	7666.0	10860.0	111.3	21.10	29.45	1497.0	1.00457
400.0	1.438	.7134	8088.0	11450.0	112.8	21.05	29.39	1535.0	1.00434

2.60 MPa isobar

14.65*	78.32	38.85	-619.0	-552.1	10.21	10.78	13.93	1327.0	1.25616
15.0	78.07	38.73	-614.3	-547.2	10.54	10.48	13.76	1321.0	1.25529
16.0	77.35	38.37	-601.2	-533.4	11.43	10.19	13.89	1303.0	1.25274
18.0	75.79	37.59	-573.4	-504.3	13.15	10.67	15.42	1264.0	1.24725
20.0	74.05	36.73	-542.3	-471.5	14.87	11.37	17.37	1222.0	1.24116
22.0	72.12	35.78	-507.4	-434.7	16.62	11.93	19.41	1177.0	1.23443
24.0	69.98	34.71	-468.7	-393.8	18.40	12.32	21.54	1128.0	1.22697
26.0	67.58	33.52	-426.0	-348.4	20.22	12.60	23.90	1072.0	1.21865
28.0	64.85	32.17	-378.7	-297.9	22.09	12.80	26.71	1009.0	1.20926
29.0	63.34	31.42	-353.1	-270.4	23.05	12.89	28.38	973.8	1.20407
30.0	61.71	30.61	-326.0	-241.1	24.05	12.97	30.31	936.3	1.19847
31.0	59.92	29.72	-297.1	-209.7	25.08	13.06	32.59	896.1	1.19238
32.0	57.96	28.75	-266.2	-175.7	26.15	13.15	35.36	852.9	1.18570
33.0	55.77	27.66	-232.7	-138.7	27.29	13.26	38.84	806.6	1.17828
34.0	53.29	26.44	-196.1	-97.7	28.51	13.40	43.36	756.9	1.16993
35.0	50.44	25.02	-155.4	-51.5	29.86	13.57	49.45	704.2	1.16035
36.0	47.08	23.35	-109.4	1.9	31.36	13.79	57.78	649.6	1.14916
36.5	45.17	22.41	-83.9	32.1	32.19	13.92	62.86	622.6	1.14283
37.0	43.10	21.38	-56.7	64.9	33.08	14.06	68.29	597.0	1.13600
38.0	38.59	19.14	2.3	138.1	35.03	14.32	77.29	554.5	1.12119
39.0	34.08	16.91	62.9	216.7	37.08	14.43	78.26	529.7	1.10652
39.5	32.04	15.89	91.6	255.2	38.06	14.41	75.67	523.7	1.09992
40.0	30.20	14.98	118.6	292.1	38.99	14.36	71.99	520.6	1.09399
40.5	28.56	14.17	143.6	327.1	39.86	14.28	67.90	519.8	1.08875
41.0	27.12	13.45	166.8	360.0	40.66	14.18	63.81	520.5	1.08414
41.5	25.85	12.82	188.2	391.0	41.41	14.08	59.98	522.3	1.08008
42.0	24.72	12.26	208.1	420.1	42.11	13.98	56.50	524.8	1.07650
42.5	23.72	11.77	226.6	447.5	42.76	13.88	53.40	527.7	1.07332
43.0	22.82	11.32	243.9	473.5	43.37	13.79	50.66	531.0	1.07048
43.5	22.02	10.92	260.2	498.2	43.94	13.70	48.25	534.6	1.06793
44.0	21.28	10.56	275.6	521.8	44.48	13.62	46.13	538.2	1.06562
44.5	20.62	10.23	290.2	544.4	44.99	13.55	44.26	542.0	1.06353
45.0	20.01	9.926	304.2	566.1	45.48	13.49	42.61	545.8	1.06161
46.0	18.93	9.390	330.4	607.3	46.38	13.38	39.85	553.5	1.05822

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
47.0	18.00	8.930	354.9	646.0	47.21	13.29	37.65	561.2	1.05531
48.0	17.19	8.527	377.8	682.7	47.99	13.23	35.87	568.8	1.05277
49.0	16.47	8.171	399.7	717.9	48.71	13.18	34.41	576.2	1.05053
50.0	15.83	7.853	420.6	751.6	49.39	13.14	33.19	583.5	1.04852
51.0	15.25	7.566	440.7	784.3	50.04	13.12	32.17	590.6	1.04672
52.0	14.73	7.305	460.1	816.0	50.66	13.11	31.31	597.5	1.04509
53.0	14.25	7.067	479.1	847.0	51.25	13.11	30.57	604.3	1.04359
54.0	13.81	6.848	497.5	877.2	51.81	13.12	29.93	610.8	1.04222
56.0	13.02	6.458	533.4	936.0	52.88	13.17	28.90	623.4	1.03978
58.0	12.34	6.119	568.1	993.0	53.88	13.24	28.12	635.4	1.03767
60.0	11.74	5.822	602.0	1049.0	54.82	13.35	27.53	646.6	1.03581
62.0	11.20	5.557	635.3	1103.0	55.72	13.47	27.08	657.3	1.03417
64.0	10.72	5.320	668.2	1157.0	56.57	13.62	26.74	667.3	1.03269
66.0	10.29	5.105	700.9	1210.0	57.39	13.80	26.50	676.9	1.03136
68.0	9.899	4.910	733.5	1263.0	58.18	13.99	26.34	686.0	1.03015
70.0	9.539	4.732	766.1	1316.0	58.94	14.20	26.24	694.6	1.02904
72.0	9.208	4.567	798.8	1368.0	59.68	14.44	26.20	702.8	1.02802
74.0	8.902	4.416	831.6	1420.0	60.40	14.69	26.20	710.6	1.02708
76.0	8.619	4.275	864.7	1473.0	61.10	14.95	26.25	718.2	1.02621
78.0	8.355	4.144	898.1	1525.0	61.78	15.23	26.34	725.4	1.02540
80.0	8.109	4.022	931.9	1578.0	62.45	15.53	26.46	732.4	1.02465
85.0	7.559	3.750	1018.0	1712.0	64.06	16.31	26.87	748.8	1.02296
90.0	7.085	3.515	1107.0	1847.0	65.61	17.14	27.41	764.3	1.02151
95.0	6.672	3.310	1200.0	1986.0	67.11	18.00	28.03	779.0	1.02025
100.0	6.309	3.129	1297.0	2128.0	68.57	18.87	28.70	793.4	1.01914
105.0	5.985	2.969	1397.0	2273.0	69.98	19.72	29.38	807.4	1.01815
110.0	5.695	2.825	1501.0	2421.0	71.37	20.54	30.06	821.4	1.01727
115.0	5.434	2.696	1609.0	2573.0	72.72	21.30	30.70	835.3	1.01647
120.0	5.197	2.578	1720.0	2728.0	74.03	21.99	31.29	849.3	1.01575
125.0	4.981	2.471	1834.0	2886.0	75.32	22.61	31.81	863.4	1.01509
130.0	4.783	2.372	1950.0	3046.0	76.58	23.13	32.25	877.5	1.01449
135.0	4.600	2.282	2069.0	3208.0	77.80	23.58	32.63	891.8	1.01393
140.0	4.432	2.198	2190.0	3372.0	79.00	23.96	32.95	906.0	1.01342
150.0	4.131	2.049	2435.0	3704.0	81.29	24.48	33.37	934.7	1.01250
160.0	3.870	1.920	2684.0	4039.0	83.45	24.74	33.54	963.5	1.01171
170.0	3.640	1.806	2934.0	4374.0	85.48	24.78	33.52	992.2	1.01101
180.0	3.437	1.705	3184.0	4709.0	87.39	24.67	33.35	1021.0	1.01040
190.0	3.256	1.615	3431.0	5041.0	89.19	24.45	33.08	1049.0	1.00985
200.0	3.094	1.535	3676.0	5370.0	90.88	24.17	32.76	1077.0	1.00935
210.0	2.947	1.462	3917.0	5696.0	92.47	23.86	32.41	1105.0	1.00891
220.0	2.814	1.396	4155.0	6018.0	93.97	23.53	32.06	1132.0	1.00850
230.0	2.692	1.335	4390.0	6337.0	95.38	23.21	31.72	1159.0	1.00814
240.0	2.581	1.280	4622.0	6653.0	96.73	22.91	31.40	1185.0	1.00780
250.0	2.478	1.229	4850.0	6965.0	98.00	22.64	31.10	1211.0	1.00749
260.0	2.384	1.182	5076.0	7275.0	99.22	22.39	30.84	1236.0	1.00720
270.0	2.296	1.139	5299.0	7582.0	100.4	22.17	30.60	1261.0	1.00694
280.0	2.215	1.099	5521.0	7887.0	101.5	21.98	30.40	1285.0	1.00669
300.0	2.069	1.026	5958.0	8491.0	103.6	21.67	30.07	1331.0	1.00625
320.0	1.941	.9628	6390.0	9090.0	105.5	21.44	29.83	1375.0	1.00586
340.0	1.828	.9067	6818.0	9685.0	107.3	21.29	29.66	1418.0	1.00552
360.0	1.727	.8569	7243.0	10280.0	109.0	21.18	29.54	1459.0	1.00522
380.0	1.637	.8123	7666.0	10870.0	110.6	21.11	29.46	1498.0	1.00494
400.0	1.556	.7721	8088.0	11460.0	112.1	21.05	29.40	1537.0	1.00470

2.80 MPa isobar

14.71*	78.42	38.90	-618.7	-546.7	10.23	10.75	13.85	1327.0	1.25652
15.0	78.22	38.80	-614.9	-542.7	10.50	10.51	13.71	1323.0	1.25582
16.0	77.51	38.45	-601.8	-529.0	11.38	10.21	13.83	1307.0	1.25330
18.0	75.97	37.68	-574.3	-500.0	13.09	10.67	15.34	1270.0	1.24788
20.0	74.25	36.83	-543.4	-467.4	14.80	11.36	17.27	1230.0	1.24187
22.0	72.36	35.89	-508.9	-430.9	16.54	11.92	19.27	1186.0	1.23524
24.0	70.25	34.85	-470.6	-390.3	18.31	12.31	21.35	1139.0	1.22791

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
26.0	67.90	33.68	-428.5	-345.4	20.10	12.59	23.62	1085.0	1.21977
28.0	65.25	32.37	-382.1	-295.6	21.95	12.79	26.27	1024.0	1.21064
29.0	63.79	31.64	-357.0	-268.5	22.90	12.87	27.82	991.1	1.20562
30.0	62.22	30.87	-330.5	-239.8	23.87	12.95	29.59	955.5	1.20023
31.0	60.52	30.02	-302.5	-209.2	24.87	13.03	31.64	917.5	1.19442
32.0	58.66	29.10	-272.6	-176.4	25.91	13.11	34.07	877.0	1.18810
33.0	56.62	28.09	-240.6	-140.9	27.01	13.20	37.01	833.9	1.18117
34.0	54.34	26.96	-206.0	-102.2	28.16	13.31	40.69	788.2	1.17348
35.0	51.78	25.68	-168.2	-59.2	29.41	13.44	45.37	740.1	1.16485
36.0	48.85	24.23	-126.5	-11.0	30.77	13.61	51.42	690.3	1.15505
37.0	45.48	22.56	-80.0	44.1	32.28	13.81	58.95	641.1	1.14385
38.0	41.66	20.67	-28.4	107.1	33.95	14.02	66.82	597.0	1.13125
39.0	37.60	18.65		26.6	35.76	14.19	71.56	564.2	1.11795
40.0	33.73	16.73		80.9	248.2	37.57	14.23	545.6	1.10538
40.5	31.98	15.87		106.5	283.0	38.44	14.21	540.8	1.09974
41.0	30.39	15.08		130.7	316.4	39.26	14.16	538.3	1.09462
41.5	28.96	14.36		153.5	348.4	40.03	14.09	537.5	1.09001
42.0	27.66	13.72		174.8	378.9	40.76	14.02	537.9	1.08587
42.5	26.50	13.15		194.8	407.8	41.45	13.94	539.2	1.08216
43.0	25.46	12.63		213.6	435.3	42.09	13.85	541.2	1.07883
43.5	24.51	12.16		231.3	461.6	42.70	13.77	543.6	1.07583
44.0	23.65	11.73		248.0	486.6	43.27	13.70	546.4	1.07312
44.5	22.88	11.35		263.8	510.6	43.81	13.63	549.5	1.07065
45.0	22.16	10.99		278.9	533.6	44.33	13.56	552.7	1.06839
46.0	20.90	10.37		307.1	577.1	45.28	13.45	559.4	1.06442
47.0	19.83	9.835		333.2	617.9	46.16	13.36	566.4	1.06103
48.0	18.89	9.370		357.6	656.4	46.97	13.28	573.5	1.05809
49.0	18.06	8.961		380.6	693.1	47.73	13.23	580.6	1.05550
50.0	17.33	8.597		402.6	728.3	48.44	13.19	587.5	1.05321
51.0	16.67	8.270		423.6	762.2	49.11	13.16	594.4	1.05115
52.0	16.08	7.975		443.9	795.0	49.75	13.15	601.1	1.04929
53.0	15.53	7.706		463.5	826.9	50.36	13.15	607.7	1.04760
54.0	15.04	7.459		482.7	858.0	50.94	13.15	614.1	1.04605
56.0	14.16	7.022		519.6	918.4	52.03	13.19	626.5	1.04331
58.0	13.39	6.644		555.3	976.7	53.06	13.27	638.2	1.04095
60.0	12.73	6.313		589.9	1033.0	54.02	13.36	649.4	1.03888
62.0	12.14	6.020		623.9	1089.0	54.93	13.49	659.9	1.03705
64.0	11.61	5.758		657.5	1144.0	55.80	13.64	669.9	1.03542
66.0	11.13	5.522		690.7	1198.0	56.63	13.81	679.4	1.03395
68.0	10.70	5.308		723.7	1251.0	57.43	14.01	688.4	1.03262
70.0	10.31	5.112		756.8	1304.0	58.20	14.22	697.0	1.03140
72.0	9.944	4.933		789.8	1357.0	58.95	14.45	705.2	1.03029
74.0	9.610	4.767		823.0	1410.0	59.67	14.70	713.0	1.02926
76.0	9.300	4.613		856.4	1463.0	60.38	14.97	720.4	1.02831
78.0	9.013	4.471		890.1	1516.0	61.07	15.25	727.6	1.02742
80.0	8.745	4.338		924.2	1570.0	61.74	15.54	734.6	1.02660
82.0	8.494	4.213		958.6	1623.0	62.40	15.84	741.3	1.02583
85.0	8.147	4.041		1011.0	1704.0	63.37	16.32	751.0	1.02476
90.0	7.633	3.786		1101.0	1840.0	64.93	17.15	766.4	1.02319
95.0	7.185	3.564		1194.0	1980.0	66.44	18.01	781.1	1.02182
100.0	6.792	3.369		1291.0	2122.0	67.90	18.88	795.4	1.02061
105.0	6.442	3.195		1392.0	2268.0	69.32	19.73	809.4	1.01955
110.0	6.129	3.040		1496.0	2417.0	70.71	20.55	823.4	1.01859
115.0	5.847	2.900		1604.0	2569.0	72.06	21.31	837.3	1.01773
120.0	5.591	2.773		1715.0	2725.0	73.38	22.00	851.2	1.01695
125.0	5.358	2.658		1829.0	2883.0	74.67	22.62	865.3	1.01624
130.0	5.144	2.552		1946.0	3043.0	75.93	23.14	879.5	1.01559
135.0	4.948	2.454		2065.0	3206.0	77.16	23.59	893.7	1.01499
140.0	4.767	2.364		2186.0	3370.0	78.36	23.97	907.9	1.01444
150.0	4.443	2.204		2432.0	3703.0	80.65	24.49	936.6	1.01345
160.0	4.161	2.064		2681.0	4038.0	82.81	24.75	965.4	1.01260
170.0	3.915	1.942		2932.0	4374.0	84.85	24.79	994.1	1.01185
180.0	3.696	1.834		3181.0	4708.0	86.76	24.68	1023.0	1.01118

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p	Sound m/s	Diel. const.
190.0	3.502	1.737	3429.0	5041.0	88.56	24.46	33.11	1051.0	1.01059
200.0	3.327	1.650	3674.0	5371.0	90.25	24.18	32.79	1079.0	1.01006
210.0	3.169	1.572	3915.0	5697.0	91.84	23.86	32.44	1107.0	1.00958
220.0	3.026	1.501	4154.0	6019.0	93.34	23.54	32.08	1134.0	1.00915
230.0	2.895	1.436	4389.0	6338.0	94.76	23.22	31.74	1161.0	1.00875
240.0	2.775	1.377	4620.0	6654.0	96.10	22.92	31.41	1187.0	1.00839
250.0	2.665	1.322	4849.0	6967.0	97.38	22.64	31.12	1213.0	1.00805
260.0	2.564	1.272	5075.0	7276.0	98.59	22.39	30.85	1238.0	1.00775
270.0	2.470	1.225	5298.0	7584.0	99.75	22.17	30.61	1262.0	1.00746
280.0	2.382	1.182	5520.0	7889.0	100.9	21.98	30.41	1286.0	1.00720
300.0	2.225	1.104	5957.0	8494.0	103.0	21.67	30.08	1333.0	1.00672
320.0	2.088	1.036	6389.0	9093.0	104.9	21.45	29.84	1377.0	1.00631
340.0	1.966	.9754	6817.0	9687.0	106.7	21.29	29.67	1419.0	1.00594
360.0	1.858	.9218	7242.0	10280.0	108.4	21.19	29.55	1460.0	1.00561
380.0	1.762	.8739	7665.0	10870.0	110.0	21.11	29.46	1500.0	1.00532
400.0	1.675	.8307	8087.0	11460.0	111.5	21.06	29.40	1538.0	1.00506
3.00 MPa isobar									
14.77 ^a	78.53	38.95	-618.4	-541.4	10.24	10.72	13.77	1327.0	1.25689
15.0	78.37	38.88	-615.4	-538.3	10.45	10.53	13.66	1324.0	1.25634
16.0	77.67	38.53	-602.5	-524.6	11.33	10.22	13.78	1310.0	1.25386
18.0	76.14	37.77	-575.1	-495.7	13.03	10.67	15.25	1276.0	1.24850
20.0	74.45	36.93	-544.5	-463.3	14.74	11.36	17.18	1237.0	1.24257
22.0	72.58	36.00	-510.3	-427.0	16.47	11.91	19.14	1196.0	1.23603
24.0	70.51	34.98	-472.5	-386.7	18.22	12.31	21.16	1149.0	1.22883
26.0	68.22	33.84	-430.9	-342.2	20.00	12.58	23.36	1098.0	1.22086
28.0	65.64	32.56	-385.2	-293.1	21.82	12.77	25.88	1039.0	1.21196
30.0	62.71	31.11	-334.8	-238.3	23.70	12.93	28.96	973.5	1.20190
31.0	61.08	30.30	-307.5	-208.5	24.68	13.00	30.82	937.5	1.19632
32.0	59.31	29.42	-278.6	-176.6	25.70	13.07	32.98	899.3	1.19031
33.0	57.39	28.47	-247.8	-142.4	26.75	13.15	35.53	858.9	1.18377
34.0	55.27	27.42	-214.8	-105.4	27.85	13.24	38.62	816.4	1.17661
35.0	52.92	26.25	-179.2	-64.9	29.03	13.35	42.40	771.9	1.16870
36.0	50.30	24.95	-140.5	-20.3	30.28	13.48	47.07	726.1	1.15988
37.0	47.34	23.48	-98.2	29.6	31.65	13.63	52.74	680.3	1.15002
38.0	44.03	21.84	-51.9	85.4	33.14	13.80	59.00	637.2	1.13906
39.0	40.45	20.06	-2.3	147.2	34.74	13.96	64.30	601.0	1.12726
40.0	36.82	18.27	48.7	212.9	36.41	14.06	66.37	575.4	1.11542
41.0	33.46	16.60	97.9	278.7	38.03	14.07	64.57	561.0	1.10450
41.5	31.94	15.84	121.1	310.5	38.80	14.04	62.67	557.2	1.09959
42.0	30.54	15.15	143.2	341.3	39.54	13.99	60.43	555.1	1.09508
42.5	29.26	14.51	164.2	370.9	40.24	13.94	58.05	554.3	1.09098
43.0	28.09	13.93	184.0	399.3	40.90	13.87	55.66	554.6	1.08724
43.5	27.03	13.41	202.8	426.6	41.53	13.81	53.35	555.6	1.08384
44.0	26.06	12.93	220.6	452.7	42.13	13.74	51.18	557.2	1.08075
44.5	25.17	12.49	237.5	477.8	42.70	13.68	49.15	559.2	1.07792
45.0	24.36	12.08	253.6	501.9	43.24	13.62	47.30	561.6	1.07534
46.0	22.92	11.37	283.6	547.5	44.24	13.50	44.05	567.1	1.07079
47.0	21.69	10.76	311.3	590.2	45.16	13.41	41.37	573.1	1.06690
48.0	20.62	10.23	337.2	630.4	46.00	13.34	39.15	579.4	1.06354
49.0	19.69	9.766	361.4	668.6	46.79	13.28	37.31	585.9	1.06060
50.0	18.86	9.355	384.4	705.1	47.53	13.23	35.77	592.4	1.05799
51.0	18.12	8.987	406.4	740.2	48.23	13.20	34.48	598.9	1.05567
52.0	17.45	8.655	427.5	774.1	48.88	13.19	33.38	605.4	1.05358
53.0	16.84	8.354	447.9	807.0	49.51	13.18	32.44	611.7	1.05168
54.0	16.29	8.079	467.7	839.1	50.11	13.18	31.63	617.9	1.04994
56.0	15.31	7.592	505.8	901.0	51.23	13.22	30.33	630.0	1.04689
58.0	14.46	7.174	542.4	960.6	52.28	13.29	29.34	641.5	1.04426
60.0	13.73	6.809	577.9	1018.0	53.26	13.38	28.58	652.5	1.04198
62.0	13.08	6.487	612.6	1075.0	54.19	13.51	28.01	662.9	1.03997
64.0	12.50	6.200	646.7	1131.0	55.07	13.66	27.57	672.8	1.03817

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
66.0	11.98	5.941	680.5	1185.0	55.91	13.83	27.24	682.2	1.03656
68.0	11.51	5.707	714.0	1240.0	56.72	14.02	27.01	691.1	1.03510
70.0	11.08	5.494	747.4	1293.0	57.50	14.23	26.85	699.6	1.03378
72.0	10.68	5.299	780.9	1347.0	58.26	14.46	26.76	707.7	1.03256
74.0	10.32	5.119	814.4	1401.0	58.99	14.71	26.72	715.4	1.03144
76.0	9.983	4.952	848.2	1454.0	59.71	14.98	26.73	722.9	1.03041
78.0	9.671	4.797	882.2	1508.0	60.40	15.26	26.79	730.0	1.02945
80.0	9.381	4.653	916.5	1561.0	61.08	15.55	26.88	736.9	1.02855
82.0	9.110	4.519	951.1	1615.0	61.74	15.86	27.00	743.6	1.02772
85.0	8.734	4.333	1004.0	1696.0	62.72	16.33	27.23	753.2	1.02657
90.0	8.180	4.057	1094.0	1834.0	64.29	17.17	27.72	768.6	1.02487
95.0	7.697	3.818	1188.0	1974.0	65.80	18.03	28.30	783.2	1.02339
100.0	7.274	3.608	1285.0	2117.0	67.27	18.89	28.94	797.5	1.02209
105.0	6.898	3.422	1386.0	2263.0	68.70	19.74	29.60	811.5	1.02094
110.0	6.561	3.255	1491.0	2413.0	70.09	20.56	30.25	825.4	1.01991
115.0	6.258	3.104	1599.0	2566.0	71.45	21.32	30.87	839.3	1.01899
120.0	5.984	2.968	1711.0	2721.0	72.77	22.02	31.45	853.2	1.01815
125.0	5.734	2.844	1825.0	2880.0	74.07	22.63	31.96	867.3	1.01738
130.0	5.505	2.731	1942.0	3041.0	75.33	23.15	32.39	881.4	1.01669
135.0	5.294	2.626	2061.0	3204.0	76.56	23.60	32.75	895.7	1.01604
140.0	5.100	2.530	2182.0	3368.0	77.76	23.98	33.07	909.9	1.01545
150.0	4.753	2.358	2429.0	3701.0	80.05	24.50	33.47	938.5	1.01440
160.0	4.452	2.208	2678.0	4037.0	82.22	24.76	33.63	967.3	1.01348
170.0	4.188	2.078	2929.0	4373.0	84.26	24.80	33.59	996.0	1.01268
180.0	3.955	1.962	3179.0	4708.0	86.17	24.69	33.42	1025.0	1.01197
190.0	3.746	1.858	3427.0	5041.0	87.97	24.47	33.14	1053.0	1.01133
200.0	3.559	1.766	3672.0	5371.0	89.67	24.18	32.81	1081.0	1.01077
210.0	3.391	1.682	3914.0	5697.0	91.26	23.87	32.46	1109.0	1.01025
220.0	3.237	1.606	4152.0	6020.0	92.76	23.54	32.10	1136.0	1.00979
230.0	3.098	1.537	4387.0	6339.0	94.18	23.23	31.76	1163.0	1.00937
240.0	2.970	1.473	4619.0	6655.0	95.52	22.93	31.43	1189.0	1.00898
250.0	2.852	1.415	4847.0	6968.0	96.80	22.65	31.13	1215.0	1.00862
260.0	2.743	1.361	5073.0	7278.0	98.02	22.40	30.87	1240.0	1.00829
270.0	2.643	1.311	5297.0	7585.0	99.18	22.18	30.63	1264.0	1.00799
280.0	2.549	1.265	5518.0	7891.0	100.3	21.99	30.42	1288.0	1.00770
300.0	2.381	1.181	5956.0	8496.0	102.4	21.68	30.09	1334.0	1.00719
320.0	2.234	1.108	6388.0	9095.0	104.3	21.45	29.85	1379.0	1.00675
340.0	2.105	1.044	6816.0	9690.0	106.1	21.30	29.67	1421.0	1.00636
360.0	1.989	.9867	7242.0	10280.0	107.8	21.19	29.55	1462.0	1.00601
380.0	1.886	.9354	7665.0	10870.0	109.4	21.11	29.47	1501.0	1.00569
400.0	1.793	.8892	8087.0	11460.0	110.9	21.06	29.41	1540.0	1.00541

3.50 MPa isobar

14.93 ^a	78.79	39.08	-617.6	-528.1	10.28	10.64	13.57	1330.0	1.25780
15.0	78.74	39.06	-616.7	-527.1	10.34	10.58	13.55	1329.0	1.25763
16.0	78.06	38.72	-603.9	-513.6	11.21	10.24	13.64	1319.0	1.25523
18.0	76.58	37.99	-577.1	-485.0	12.90	10.66	15.09	1290.0	1.25002
20.0	74.94	37.17	-547.1	-453.0	14.58	11.34	16.95	1256.0	1.24426
22.0	73.13	36.28	-513.7	-417.2	16.28	11.89	18.84	1217.0	1.23795
24.0	71.15	35.29	-476.8	-377.6	18.01	12.28	20.75	1175.0	1.23102
26.0	68.96	34.21	-436.4	-334.1	19.74	12.56	22.77	1127.0	1.22342
28.0	66.53	33.00	-392.4	-286.4	21.51	12.75	25.02	1074.0	1.21504
30.0	63.82	31.66	-344.3	-233.8	23.33	12.89	27.65	1015.0	1.20570
31.0	62.33	30.92	-318.6	-205.4	24.26	12.95	29.17	982.6	1.20060
32.0	60.74	30.13	-291.5	-175.3	25.21	13.01	30.87	949.0	1.19518
33.0	59.04	29.29	-263.0	-143.5	26.19	13.06	32.79	913.7	1.18939
34.0	57.21	28.38	-233.0	-109.7	27.20	13.13	34.99	877.1	1.18317
36.0	53.08	26.33	-167.4	-34.5	29.35	13.27	40.42	800.4	1.16924
37.0	50.75	25.17	-131.5	7.5	30.50	13.36	43.74	761.3	1.16140
38.0	48.21	23.92	-93.2	53.1	31.71	13.46	47.43	723.1	1.15293
39.0	45.48	22.56	-52.7	102.4	32.99	13.56	51.21	687.2	1.14387
40.0	42.61	21.13	-10.2	155.4	34.33	13.66	54.52	655.6	1.13436

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
42.0	36.84	18.27	76.3	267.9	37.08	13.77	56.80	612.2	1.11547
43.0	34.20	16.97	117.8	324.1	38.40	13.76	55.42	601.0	1.10691
44.0	31.84	15.80	156.8	378.4	39.65	13.72	53.01	595.2	1.09929
45.0	29.77	14.77	193.0	430.0	40.81	13.65	50.20	593.3	1.09263
46.0	27.97	13.87	226.5	478.8	41.88	13.57	47.38	594.0	1.08685
47.0	26.40	13.10	257.5	524.8	42.87	13.49	44.77	596.4	1.08184
48.0	25.03	12.41	286.5	568.4	43.79	13.42	42.43	599.9	1.07747
49.0	23.82	11.82	313.6	609.8	44.64	13.37	40.39	604.2	1.07364
50.0	22.75	11.29	339.2	649.3	45.44	13.32	38.62	609.0	1.07026
51.0	21.80	10.81	363.4	687.1	46.19	13.29	37.10	614.1	1.06724
52.0	20.94	10.39	386.6	723.5	46.90	13.26	35.78	619.4	1.06454
53.0	20.17	10.00	408.9	758.7	47.57	13.25	34.64	624.8	1.06210
54.0	19.46	9.654	430.3	792.9	48.21	13.25	33.66	630.2	1.05988
55.0	18.82	9.333	451.1	826.1	48.82	13.26	32.80	635.7	1.05786
56.0	18.22	9.039	471.3	858.5	49.40	13.28	32.05	641.0	1.05600
58.0	17.17	8.516	510.3	921.3	50.50	13.34	30.82	651.6	1.05269
60.0	16.25	8.062	547.8	982.0	51.53	13.43	29.87	661.8	1.04984
62.0	15.45	7.664	584.3	1041.0	52.50	13.55	29.14	671.7	1.04734
64.0	14.74	7.311	620.0	1099.0	53.41	13.70	28.58	681.1	1.04513
66.0	14.10	6.996	655.1	1155.0	54.29	13.86	28.15	690.1	1.04315
68.0	13.53	6.711	689.8	1211.0	55.12	14.06	27.83	698.7	1.04137
70.0	13.01	6.453	724.3	1267.0	55.92	14.27	27.60	706.9	1.03975
72.0	12.53	6.216	758.7	1322.0	56.70	14.50	27.44	714.7	1.03828
74.0	12.09	6.000	793.2	1377.0	57.45	14.75	27.35	722.3	1.03692
76.0	11.69	5.800	827.7	1431.0	58.18	15.01	27.32	729.5	1.03568
78.0	11.32	5.615	862.5	1486.0	58.89	15.29	27.33	736.5	1.03453
80.0	10.97	5.443	897.5	1541.0	59.58	15.59	27.38	743.2	1.03345
82.0	10.65	5.282	932.8	1595.0	60.26	15.89	27.47	749.8	1.03246
85.0	10.20	5.061	986.5	1678.0	61.25	16.37	27.66	759.3	1.03108
90.0	9.544	4.734	1078.0	1817.0	62.84	17.20	28.09	774.3	1.02906
95.0	8.974	4.452	1173.0	1959.0	64.37	18.06	28.63	788.8	1.02731
100.0	8.475	4.204	1271.0	2104.0	65.86	18.92	29.23	802.9	1.02577
105.0	8.033	3.985	1373.0	2252.0	67.30	19.77	29.86	816.8	1.02441
110.0	7.638	3.789	1479.0	2402.0	68.70	20.59	30.49	830.6	1.02321
115.0	7.283	3.613	1588.0	2556.0	70.07	21.35	31.09	844.4	1.02212
120.0	6.962	3.453	1700.0	2713.0	71.41	22.04	31.64	858.3	1.02113
125.0	6.669	3.308	1815.0	2873.0	72.71	22.65	32.14	872.3	1.02024
130.0	6.402	3.176	1932.0	3034.0	73.98	23.18	32.56	886.4	1.01942
135.0	6.156	3.054	2052.0	3198.0	75.21	23.62	32.91	900.6	1.01867
140.0	5.930	2.941	2174.0	3363.0	76.41	24.01	33.21	914.8	1.01798
150.0	5.526	2.741	2421.0	3698.0	78.72	24.52	33.59	943.4	1.01675
160.0	5.175	2.567	2671.0	4034.0	80.89	24.78	33.73	972.1	1.01568
170.0	4.868	2.415	2922.0	4372.0	82.94	24.82	33.69	1001.0	1.01475
180.0	4.597	2.280	3173.0	4708.0	84.86	24.71	33.50	1029.0	1.01392
190.0	4.355	2.160	3421.0	5041.0	86.66	24.49	33.22	1058.0	1.01318
200.0	4.137	2.052	3667.0	5372.0	88.36	24.20	32.88	1086.0	1.01252
210.0	3.941	1.955	3909.0	5699.0	89.95	23.89	32.52	1114.0	1.01193
220.0	3.764	1.867	4147.0	6022.0	91.46	23.56	32.15	1141.0	1.01139
230.0	3.601	1.786	4383.0	6342.0	92.88	23.24	31.80	1167.0	1.01089
240.0	3.453	1.713	4615.0	6658.0	94.23	22.94	31.47	1194.0	1.01044
250.0	3.316	1.645	4844.0	6972.0	95.50	22.66	31.17	1219.0	1.01003
260.0	3.190	1.582	5070.0	7282.0	96.72	22.41	30.90	1244.0	1.00965
270.0	3.073	1.525	5294.0	7590.0	97.88	22.19	30.66	1269.0	1.00929
280.0	2.965	1.471	5516.0	7895.0	98.99	22.00	30.45	1292.0	1.00896
300.0	2.770	1.374	5954.0	8501.0	101.1	21.69	30.11	1339.0	1.00837
320.0	2.599	1.289	6386.0	9100.0	103.0	21.46	29.87	1383.0	1.00785
340.0	2.449	1.215	6814.0	9696.0	104.8	21.31	29.69	1425.0	1.00740
360.0	2.315	1.148	7240.0	10290.0	106.5	21.20	29.57	1466.0	1.00699
380.0	2.194	1.089	7664.0	10880.0	108.1	21.12	29.48	1505.0	1.00663
400.0	2.086	1.035	8086.0	11470.0	109.6	21.07	29.42	1543.0	1.00630

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
4.00 MPa isobar									
15.08 ^a	79.04	39.21	-616.8	-514.8	10.31	10.55	13.40	1334.0	1.25871
16.0	78.43	38.91	-605.3	-502.5	11.10	10.24	13.51	1328.0	1.25656
18.0	76.99	38.19	-578.9	-474.2	12.76	10.65	14.92	1305.0	1.25149
20.0	75.40	37.40	-549.5	-442.6	14.43	11.32	16.74	1274.0	1.24589
22.0	73.65	36.54	-516.8	-407.3	16.11	11.87	18.56	1238.0	1.23977
24.0	71.74	35.59	-480.7	-368.3	17.80	12.26	20.39	1199.0	1.23310
26.0	69.65	34.55	-441.5	-325.7	19.51	12.54	22.27	1154.0	1.22582
28.0	67.35	33.41	-398.9	-279.1	21.23	12.73	24.32	1105.0	1.21785
30.0	64.80	32.15	-352.7	-228.2	22.99	12.86	26.63	1051.0	1.20909
32.0	61.97	30.74	-302.5	-172.3	24.79	12.97	29.33	991.9	1.19938
33.0	60.43	29.98	-275.7	-142.2	25.72	13.01	30.88	960.5	1.19412
34.0	58.79	29.16	-247.7	-110.5	26.66	13.06	32.59	927.9	1.18854
36.0	55.19	27.38	-187.6	-41.5	28.64	13.16	36.56	860.5	1.17633
38.0	51.09	25.34	-121.5	36.3	30.74	13.27	41.35	792.2	1.16255
40.0	46.49	23.06	-49.3	124.2	32.99	13.41	46.49	728.4	1.14721
42.0	41.58	20.62	27.4	221.4	35.36	13.53	50.28	677.2	1.13097
44.0	36.82	18.26	103.9	322.9	37.72	13.58	50.58	645.4	1.11541
45.0	34.66	17.19	140.3	372.9	38.85	13.56	49.47	636.5	1.10838
46.0	32.69	16.21	174.9	421.6	39.92	13.53	47.85	631.3	1.10201
47.0	30.91	15.33	207.7	468.6	40.93	13.49	46.00	628.8	1.09628
48.0	29.32	14.54	238.6	513.6	41.87	13.45	44.10	628.5	1.09117
49.0	27.90	13.84	267.7	556.8	42.77	13.41	42.28	629.6	1.08662
50.0	26.62	13.21	295.3	598.2	43.60	13.37	40.59	631.9	1.08255
51.0	25.48	12.64	321.5	638.0	44.39	13.34	39.06	634.9	1.07890
52.0	24.44	12.13	346.5	676.4	45.14	13.32	37.68	638.4	1.07562
53.0	23.51	11.66	370.4	713.5	45.84	13.31	36.46	642.3	1.07265
54.0	22.66	11.24	393.5	749.4	46.51	13.31	35.38	646.5	1.06996
55.0	21.88	10.85	415.7	784.3	47.15	13.31	34.42	650.9	1.06749
56.0	21.16	10.50	437.2	818.3	47.77	13.33	33.58	655.4	1.06524
58.0	19.89	9.867	478.6	883.9	48.92	13.39	32.17	664.5	1.06124
60.0	18.80	9.323	518.1	947.1	49.99	13.47	31.07	673.6	1.05779
62.0	17.84	8.848	556.3	1008.0	50.99	13.59	30.20	682.5	1.05479
64.0	16.99	8.428	593.5	1068.0	51.94	13.73	29.53	691.2	1.05214
66.0	16.24	8.054	629.9	1127.0	52.84	13.90	29.01	699.6	1.04979
68.0	15.56	7.717	665.9	1184.0	53.70	14.09	28.61	707.6	1.04767
70.0	14.94	7.413	701.5	1241.0	54.53	14.30	28.31	715.4	1.04576
72.0	14.38	7.135	736.8	1297.0	55.32	14.53	28.09	722.9	1.04402
74.0	13.87	6.881	772.2	1354.0	56.09	14.78	27.95	730.1	1.04243
76.0	13.40	6.647	807.5	1409.0	56.83	15.04	27.87	737.1	1.04096
78.0	12.96	6.431	843.0	1465.0	57.56	15.32	27.85	743.8	1.03961
80.0	12.56	6.230	878.7	1521.0	58.26	15.62	27.87	750.3	1.03836
82.0	12.18	6.044	914.7	1577.0	58.95	15.92	27.92	756.7	1.03720
84.0	11.83	5.869	950.9	1632.0	59.62	16.24	28.02	762.9	1.03611
90.0	10.90	5.408	1062.0	1802.0	61.57	17.23	28.45	780.6	1.03324
95.0	10.24	5.082	1158.0	1945.0	63.12	18.09	28.95	794.8	1.03121
100.0	9.669	4.796	1257.0	2091.0	64.62	18.95	29.51	808.7	1.02944
105.0	9.161	4.544	1360.0	2240.0	66.07	19.80	30.11	822.4	1.02788
110.0	8.707	4.319	1466.0	2392.0	67.49	20.62	30.72	836.1	1.02648
115.0	8.300	4.117	1576.0	2548.0	68.87	21.38	31.30	849.8	1.02524
120.0	7.932	3.935	1689.0	2705.0	70.21	22.07	31.83	863.6	1.02411
125.0	7.598	3.769	1804.0	2866.0	71.52	22.68	32.31	877.5	1.02308
130.0	7.292	3.617	1923.0	3028.0	72.80	23.21	32.72	891.6	1.02215
135.0	7.012	3.478	2043.0	3193.0	74.04	23.65	33.06	905.7	1.02129
140.0	6.753	3.350	2165.0	3359.0	75.24	24.03	33.35	919.8	1.02050
145.0	6.514	3.231	2288.0	3526.0	76.42	24.32	33.56	934.1	1.01977
150.0	6.292	3.121	2413.0	3694.0	77.56	24.55	33.71	948.4	1.01909
160.0	5.893	2.923	2664.0	4032.0	79.74	24.80	33.84	977.1	1.01787
170.0	5.543	2.750	2916.0	4370.0	81.79	24.84	33.78	1006.0	1.01680
180.0	5.234	2.596	3167.0	4707.0	83.72	24.73	33.58	1034.0	1.01586
190.0	4.958	2.460	3415.0	5042.0	85.52	24.51	33.29	1063.0	1.01502
200.0	4.711	2.337	3661.0	5373.0	87.22	24.22	32.94	1091.0	1.01427
210.0	4.488	2.226	3904.0	5701.0	88.82	23.90	32.58	1118.0	1.01359

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
220.0	4.286	2.126	4143.0	6024.0	90.33	23.57	32.21	1145.0	1.01297
230.0	4.102	2.035	4379.0	6345.0	91.75	23.26	31.85	1172.0	1.01241
240.0	3.933	1.951	4611.0	6662.0	93.10	22.95	31.52	1198.0	1.01190
250.0	3.777	1.874	4840.0	6975.0	94.38	22.68	31.21	1224.0	1.01143
260.0	3.634	1.803	5067.0	7286.0	95.60	22.43	30.94	1249.0	1.01099
270.0	3.501	1.737	5291.0	7594.0	96.76	22.20	30.69	1273.0	1.01059
280.0	3.378	1.676	5513.0	7900.0	97.87	22.01	30.48	1297.0	1.01022
300.0	3.156	1.566	5951.0	8506.0	99.97	21.70	30.14	1343.0	1.00954
320.0	2.962	1.469	6384.0	9106.0	101.9	21.47	29.89	1387.0	1.00895
340.0	2.791	1.384	6813.0	9702.0	103.7	21.31	29.71	1429.0	1.00844
360.0	2.638	1.309	7239.0	10290.0	105.4	21.21	29.59	1470.0	1.00797
380.0	2.502	1.241	7662.0	10890.0	107.0	21.13	29.50	1509.0	1.00756
400.0	2.379	1.180	8085.0	11470.0	108.5	21.07	29.43	1547.0	1.00719
5.00 MPa isobar									
15.38*	79.56	39.46	-615.2	-488.5	10.37	10.37	13.12	1349.0	1.26052
16.0	79.16	39.27	-607.7	-480.4	10.88	10.22	13.25	1348.0	1.25914
18.0	77.79	38.59	-582.2	-452.6	12.52	10.59	14.61	1333.0	1.25430
20.0	76.28	37.84	-553.8	-421.7	14.15	11.26	16.36	1308.0	1.24898
22.0	74.63	37.02	-522.3	-387.2	15.79	11.82	18.09	1277.0	1.24319
24.0	72.84	36.13	-487.7	-349.4	17.43	12.22	19.77	1242.0	1.23693
26.0	70.90	35.17	-450.3	-308.1	19.08	12.50	21.46	1204.0	1.23018
28.0	68.80	34.13	-410.0	-263.5	20.73	12.69	23.22	1161.0	1.22288
30.0	66.52	33.00	-366.7	-215.2	22.40	12.83	25.11	1115.0	1.21499
32.0	64.03	31.76	-320.4	-162.9	24.09	12.92	27.19	1064.0	1.20644
34.0	61.32	30.42	-270.7	-106.3	25.80	12.99	29.52	1011.0	1.19714
36.0	58.35	28.94	-217.4	-44.7	27.56	13.05	32.13	955.6	1.18703
38.0	55.10	27.33	-160.5	22.4	29.37	13.11	35.01	899.4	1.17604
40.0	51.58	25.59	-99.9	95.4	31.25	13.18	38.05	844.8	1.16420
42.0	47.84	23.73	-36.2	174.5	33.18	13.26	40.93	794.7	1.15169
44.0	43.99	21.82	29.5	258.6	35.13	13.32	43.01	753.1	1.13893
46.0	40.23	19.96	95.1	345.6	37.06	13.36	43.71	722.6	1.12655
48.0	36.76	18.23	158.3	432.5	38.91	13.37	42.98	703.4	1.11521
50.0	33.70	16.72	217.8	516.9	40.64	13.36	41.32	693.4	1.10527
51.0	32.33	16.04	245.9	557.7	41.45	13.36	40.34	691.0	1.10085
52.0	31.06	15.41	273.0	597.6	42.22	13.36	39.33	689.8	1.09677
53.0	29.89	14.83	299.2	636.4	42.96	13.36	38.34	689.7	1.09301
54.0	28.81	14.29	324.4	674.2	43.67	13.37	37.38	690.4	1.08955
55.0	27.82	13.80	348.8	711.2	44.34	13.38	36.49	691.7	1.08636
56.0	26.89	13.34	372.4	747.2	44.99	13.40	35.65	693.6	1.08341
58.0	25.24	12.52	417.7	817.0	46.22	13.46	34.18	698.3	1.07816
60.0	23.81	11.81	460.8	884.1	47.36	13.55	32.95	704.0	1.07361
62.0	22.56	11.19	502.1	949.0	48.42	13.66	31.95	710.2	1.06964
64.0	21.45	10.64	542.1	1012.0	49.42	13.80	31.14	716.6	1.06615
66.0	20.46	10.15	581.1	1074.0	50.37	13.97	30.49	723.2	1.06304
68.0	19.58	9.713	619.3	1134.0	51.27	14.16	29.97	729.7	1.06026
70.0	18.78	9.317	657.0	1194.0	52.13	14.37	29.57	736.2	1.05775
72.0	18.06	8.957	694.2	1252.0	52.96	14.59	29.26	742.6	1.05548
74.0	17.39	8.629	731.3	1311.0	53.76	14.84	29.04	748.8	1.05341
76.0	16.79	8.327	768.2	1369.0	54.53	15.11	28.89	754.9	1.05151
78.0	16.23	8.049	805.1	1426.0	55.28	15.38	28.80	760.9	1.04976
80.0	15.71	7.792	842.2	1484.0	56.01	15.68	28.76	766.8	1.04814
82.0	15.23	7.552	879.3	1541.0	56.72	15.98	28.76	772.5	1.04664
84.0	14.78	7.330	916.8	1599.0	57.41	16.30	28.80	778.2	1.04524
86.0	14.36	7.121	954.5	1657.0	58.09	16.62	28.88	783.8	1.04393
90.0	13.59	6.743	1031.0	1773.0	59.41	17.29	29.12	794.7	1.04157
95.0	12.76	6.329	1129.0	1919.0	61.00	18.15	29.54	808.1	1.03898
100.0	12.03	5.968	1230.0	2068.0	62.52	19.01	30.04	821.4	1.03673
105.0	11.39	5.650	1335.0	2220.0	64.00	19.86	30.59	834.6	1.03475
110.0	10.82	5.368	1443.0	2374.0	65.44	20.67	31.15	847.8	1.03299
115.0	10.31	5.115	1554.0	2531.0	66.83	21.43	31.69	861.2	1.03142
120.0	9.850	4.886	1668.0	2691.0	68.19	22.12	32.19	874.7	1.03000

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
125.0	9.432	4.679	1784.0	2853.0	69.52	22.73	32.64	888.4	1.02871
130.0	9.051	4.490	1903.0	3017.0	70.80	23.26	33.02	902.3	1.02754
135.0	8.701	4.316	2025.0	3183.0	72.06	23.70	33.34	916.3	1.02647
140.0	8.380	4.157	2147.0	3350.0	73.27	24.08	33.61	930.3	1.02548
145.0	8.082	4.009	2272.0	3519.0	74.46	24.37	33.80	944.4	1.02457
150.0	7.806	3.872	2397.0	3688.0	75.61	24.59	33.93	958.6	1.02372
160.0	7.310	3.626	2649.0	4028.0	77.80	24.84	34.04	987.1	1.02220
170.0	6.876	3.411	2903.0	4368.0	79.86	24.88	33.95	1016.0	1.02087
180.0	6.493	3.221	3155.0	4707.0	81.80	24.76	33.73	1044.0	1.01970
190.0	6.152	3.052	3404.0	5043.0	83.61	24.54	33.43	1072.0	1.01866
200.0	5.846	2.900	3651.0	5375.0	85.32	24.25	33.07	1100.0	1.01773
210.0	5.570	2.763	3895.0	5704.0	86.92	23.93	32.69	1128.0	1.01689
220.0	5.320	2.639	4134.0	6029.0	88.43	23.61	32.31	1155.0	1.01612
230.0	5.092	2.526	4371.0	6350.0	89.86	23.28	31.94	1181.0	1.01543
240.0	4.883	2.422	4604.0	6668.0	91.21	22.98	31.60	1207.0	1.01479
250.0	4.691	2.327	4834.0	6982.0	92.50	22.70	31.29	1233.0	1.01421
260.0	4.513	2.239	5061.0	7294.0	93.72	22.45	31.01	1257.0	1.01367
270.0	4.349	2.157	5285.0	7603.0	94.89	22.23	30.76	1282.0	1.01317
280.0	4.197	2.082	5507.0	7909.0	96.00	22.03	30.54	1305.0	1.01270
300.0	3.922	1.946	5946.0	8516.0	98.09	21.72	30.19	1351.0	1.01187
320.0	3.682	1.827	6380.0	9117.0	100.0	21.49	29.93	1395.0	1.01114
340.0	3.470	1.721	6809.0	9714.0	101.8	21.33	29.75	1437.0	1.01049
360.0	3.281	1.628	7236.0	10310.0	103.5	21.22	29.62	1477.0	1.00992
380.0	3.112	1.544	7660.0	10900.0	105.1	21.14	29.52	1517.0	1.00941
400.0	2.959	1.468	8083.0	11490.0	106.7	21.09	29.46	1555.0	1.00895

10.00 MPa isobar

16.81 ^a	81.94	40.65	-606.4	-360.4	10.58	9.76	12.59	1470.0	1.26896
18.0	81.23	40.29	-593.0	-344.8	11.47	10.15	13.47	1471.0	1.26644
20.0	79.97	39.67	-568.4	-316.3	12.97	10.91	15.05	1458.0	1.26198
22.0	78.63	39.00	-541.1	-284.7	14.47	11.56	16.52	1438.0	1.25723
24.0	77.20	38.30	-511.4	-250.3	15.97	12.03	17.86	1415.0	1.25222
26.0	75.71	37.55	-479.6	-213.3	17.45	12.38	19.11	1389.0	1.24696
28.0	74.13	36.77	-445.8	-173.9	18.91	12.63	20.30	1361.0	1.24145
30.0	72.49	35.96	-410.3	-132.2	20.35	12.81	21.45	1332.0	1.23570
32.0	70.77	35.10	-373.0	-88.1	21.77	12.94	22.58	1301.0	1.22971
34.0	68.97	34.21	-334.1	-41.9	23.17	13.03	23.70	1270.0	1.22349
40.0	63.19	31.34	-208.8	110.2	27.28	13.18	26.98	1171.0	1.20354
45.0	58.00	28.77	-96.1	251.5	30.61	13.27	29.45	1091.0	1.18585
50.0	52.70	26.14	21.2	403.7	33.81	13.36	31.31	1022.0	1.16794
55.0	47.57	23.60	139.4	563.2	36.85	13.51	32.31	968.4	1.15079
60.0	42.88	21.27	255.4	725.4	39.68	13.76	32.48	930.9	1.13528
62.0	41.17	20.42	300.7	790.3	40.74	13.90	32.39	920.1	1.12964
64.0	39.56	19.62	345.4	855.0	41.77	14.05	32.24	911.2	1.12436
66.0	38.05	18.87	389.4	919.3	42.76	14.23	32.06	904.0	1.11942
68.0	36.63	18.17	432.9	983.2	43.71	14.42	31.86	898.4	1.11480
70.0	35.31	17.52	475.8	1047.0	44.63	14.63	31.68	894.1	1.11051
72.0	34.08	16.90	518.3	1110.0	45.52	14.86	31.50	890.9	1.10651
74.0	32.92	16.33	560.5	1173.0	46.38	15.11	31.36	888.6	1.10278
76.0	31.85	15.80	602.3	1235.0	47.22	15.37	31.23	887.1	1.09930
78.0	30.84	15.30	644.0	1298.0	48.03	15.65	31.14	886.2	1.09606
80.0	29.90	14.83	685.6	1360.0	48.81	15.94	31.09	886.0	1.09303
82.0	29.01	14.39	727.2	1422.0	49.58	16.25	31.06	886.2	1.09019
85.0	27.79	13.78	789.7	1515.0	50.70	16.72	31.07	887.4	1.08626
90.0	25.97	12.88	894.7	1671.0	52.48	17.55	31.21	891.2	1.08047
95.0	24.40	12.10	1001.0	1828.0	54.17	18.40	31.49	896.7	1.07547
100.0	23.02	11.42	1110.0	1986.0	55.79	19.27	31.85	903.6	1.07109
105.0	21.80	10.81	1221.0	2146.0	57.36	20.11	32.27	911.7	1.06724
110.0	20.71	10.27	1335.0	2309.0	58.87	20.92	32.71	920.8	1.06382
115.0	19.74	9.792	1452.0	2473.0	60.33	21.67	33.14	930.7	1.06076
120.0	18.86	9.357	1571.0	2640.0	61.75	22.36	33.54	941.3	1.05801

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
125.0	18.07	8.962	1693.0	2809.0	63.13	22.96	33.90	952.6	1.05551
130.0	17.34	8.602	1816.0	2979.0	64.46	23.48	34.20	964.5	1.05324
135.0	16.68	8.273	1942.0	3151.0	65.76	23.92	34.44	976.7	1.05116
140.0	16.07	7.969	2068.0	3323.0	67.02	24.30	34.65	989.2	1.04926
145.0	15.50	7.689	2196.0	3497.0	68.23	24.58	34.78	1002.0	1.04749
150.0	14.98	7.429	2325.0	3671.0	69.42	24.80	34.85	1015.0	1.04587
160.0	14.04	6.963	2583.0	4020.0	71.67	25.04	34.85	1042.0	1.04294
170.0	13.21	6.555	2842.0	4367.0	73.77	25.07	34.68	1069.0	1.04039
180.0	12.49	6.195	3099.0	4713.0	75.75	24.94	34.39	1096.0	1.03814
190.0	11.84	5.875	3353.0	5055.0	77.60	24.71	34.02	1123.0	1.03615
200.0	11.26	5.588	3604.0	5393.0	79.33	24.41	33.60	1150.0	1.03436
210.0	10.74	5.329	3850.0	5727.0	80.96	24.08	33.18	1176.0	1.03275
220.0	10.27	5.094	4094.0	6057.0	82.50	23.75	32.75	1203.0	1.03129
230.0	9.837	4.880	4333.0	6382.0	83.94	23.42	32.35	1228.0	1.02996
240.0	9.441	4.683	4569.0	6704.0	85.31	23.11	31.97	1254.0	1.02874
250.0	9.077	4.503	4801.0	7022.0	86.61	22.83	31.63	1278.0	1.02762
260.0	8.741	4.336	5030.0	7336.0	87.84	22.57	31.32	1302.0	1.02659
280.0	8.141	4.038	5481.0	7958.0	90.15	22.14	30.81	1349.0	1.02475
300.0	7.620	3.780	5924.0	8570.0	92.26	21.82	30.42	1394.0	1.02315
320.0	7.163	3.553	6360.0	9175.0	94.21	21.58	30.13	1436.0	1.02175
340.0	6.758	3.352	6793.0	9775.0	96.03	21.42	29.92	1477.0	1.02051
360.0	6.398	3.174	7221.0	10370.0	97.74	21.30	29.77	1516.0	1.01941
380.0	6.075	3.013	7648.0	10970.0	99.34	21.22	29.66	1554.0	1.01842
400.0	5.783	2.869	8073.0	11560.0	100.9	21.16	29.57	1592.0	1.01753

15.00 MPa isobar

18.12 ^a	83.96	41.65	-596.8	-236.6	10.70	9.78	12.88	1604.0	1.27613
20.0	82.90	41.12	-575.9	-211.2	12.04	10.62	14.28	1590.0	1.27236
25.0	79.87	39.62	-510.2	-131.6	15.58	12.12	17.38	1536.0	1.26162
30.0	76.55	37.97	-433.5	-38.4	18.97	12.84	19.84	1478.0	1.24991
35.0	72.96	36.19	-348.2	66.3	22.19	13.20	22.00	1417.0	1.23734
40.0	69.14	34.30	-256.2	181.2	25.26	13.38	23.94	1355.0	1.22407
50.0	61.13	30.32	-57.0	437.7	30.97	13.64	27.17	1236.0	1.19649
60.0	53.25	26.42	152.6	720.4	36.12	14.05	29.17	1139.0	1.16980
65.0	49.61	24.61	258.4	867.9	38.48	14.42	29.77	1102.0	1.15760
70.0	46.26	22.95	364.2	1018.0	40.70	14.91	30.21	1072.0	1.14645
75.0	43.22	21.44	470.2	1170.0	42.80	15.51	30.55	1049.0	1.13639
80.0	40.49	20.09	576.5	1323.0	44.78	16.21	30.87	1032.0	1.12741
85.0	38.05	18.88	683.8	1478.0	46.66	16.98	31.21	1020.0	1.11942
90.0	35.87	17.79	792.5	1635.0	48.45	17.80	31.58	1012.0	1.11233
95.0	33.92	16.83	903.0	1794.0	50.17	18.64	32.01	1008.0	1.10601
100.0	32.18	15.96	1016.0	1956.0	51.83	19.50	32.46	1006.0	1.10037
105.0	30.61	15.18	1131.0	2119.0	53.42	20.34	32.93	1007.0	1.09531
110.0	29.19	14.48	1249.0	2285.0	54.96	21.14	33.39	1010.0	1.09076
115.0	27.90	13.84	1369.0	2453.0	56.46	21.89	33.84	1015.0	1.08664
120.0	26.73	13.26	1492.0	2623.0	57.91	22.57	34.24	1022.0	1.08290
125.0	25.66	12.73	1617.0	2795.0	59.31	23.17	34.59	1029.0	1.07948
130.0	24.68	12.24	1743.0	2969.0	60.67	23.68	34.87	1038.0	1.07636
135.0	23.77	11.79	1872.0	3144.0	61.99	24.11	35.10	1047.0	1.07348
140.0	22.93	11.38	2001.0	3320.0	63.27	24.49	35.28	1057.0	1.07083
150.0	21.44	10.63	2263.0	3674.0	65.72	24.98	35.45	1079.0	1.06610
160.0	20.13	9.987	2526.0	4028.0	68.00	25.21	35.41	1102.0	1.06200
170.0	18.99	9.420	2789.0	4381.0	70.14	25.23	35.20	1127.0	1.05841
180.0	17.98	8.918	3050.0	4732.0	72.15	25.10	34.86	1152.0	1.05523
190.0	17.07	8.470	3307.0	5078.0	74.02	24.86	34.46	1177.0	1.05241
200.0	16.26	8.067	3561.0	5421.0	75.78	24.55	34.01	1202.0	1.04987
210.0	15.53	7.703	3811.0	5758.0	77.43	24.22	33.55	1227.0	1.04758
220.0	14.86	7.372	4057.0	6092.0	78.98	23.88	33.10	1252.0	1.04550
230.0	14.25	7.069	4299.0	6421.0	80.44	23.54	32.67	1277.0	1.04361
240.0	13.69	6.792	4537.0	6745.0	81.82	23.23	32.27	1301.0	1.04187
250.0	13.18	6.537	4771.0	7066.0	83.13	22.94	31.91	1325.0	1.04028
260.0	12.70	6.300	5003.0	7384.0	84.37	22.68	31.58	1348.0	1.03880

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
280.0	11.85	5.878	5457.0	8009.0	86.69	22.24	31.03	1393.0	1.03616
300.0	11.11	5.510	5903.0	8626.0	88.82	21.91	30.61	1436.0	1.03387
320.0	10.46	5.186	6343.0	9235.0	90.79	21.67	30.30	1477.0	1.03186
340.0	9.878	4.900	6777.0	9838.0	92.62	21.50	30.07	1517.0	1.03008
360.0	9.362	4.644	7208.0	10440.0	94.33	21.38	29.90	1555.0	1.02850
380.0	8.899	4.414	7637.0	11030.0	95.94	21.29	29.77	1592.0	1.02707
400.0	8.480	4.207	8063.0	11630.0	97.47	21.22	29.68	1628.0	1.02579

20.00 MPa isobar

19.36*	85.68	42.50	-586.3	-115.8	10.81	10.16	13.41	1716.0	1.28229
25.0	82.64	40.99	-518.3	-30.4	14.67	12.09	16.67	1649.0	1.27144
30.0	79.73	39.55	-447.1	58.6	17.91	12.89	18.86	1593.0	1.26113
35.0	76.63	38.01	-368.4	157.7	20.96	13.32	20.74	1540.0	1.25021
40.0	73.38	36.40	-283.9	265.6	23.84	13.57	22.39	1488.0	1.23882
60.0	59.91	29.72	93.1	766.0	33.92	14.35	27.17	1299.0	1.19235
70.0	53.68	26.63	294.5	1046.0	38.22	15.20	28.70	1226.0	1.17124
75.0	50.84	25.22	397.7	1191.0	40.23	15.79	29.36	1196.0	1.16169
80.0	48.19	23.91	502.5	1339.0	42.14	16.47	29.99	1171.0	1.15286
85.0	45.75	22.69	609.4	1491.0	43.98	17.23	30.60	1151.0	1.14475
90.0	43.51	21.58	718.5	1645.0	45.74	18.04	31.21	1135.0	1.13733
95.0	41.45	20.56	830.1	1803.0	47.45	18.88	31.82	1123.0	1.13055
100.0	39.56	19.62	944.3	1963.0	49.09	19.72	32.42	1114.0	1.12436
105.0	37.83	18.77	1061.0	2127.0	50.69	20.55	32.99	1109.0	1.11871
110.0	36.24	17.98	1181.0	2293.0	52.24	21.35	33.54	1106.0	1.11354
115.0	34.78	17.25	1303.0	2462.0	53.74	22.09	34.05	1106.0	1.10879
120.0	33.44	16.59	1428.0	2634.0	55.20	22.77	34.50	1108.0	1.10443
125.0	32.19	15.97	1555.0	2807.0	56.62	23.36	34.88	1112.0	1.10042
130.0	31.04	15.40	1683.0	2982.0	57.99	23.87	35.18	1117.0	1.09670
140.0	28.98	14.37	1945.0	3336.0	60.61	24.66	35.62	1130.0	1.09008
150.0	27.18	13.48	2210.0	3694.0	63.08	25.14	35.79	1147.0	1.08434
160.0	25.61	12.70	2477.0	4052.0	65.39	25.37	35.75	1167.0	1.07932
170.0	24.21	12.01	2743.0	4408.0	67.55	25.38	35.53	1188.0	1.07489
180.0	22.97	11.40	3007.0	4762.0	69.57	25.24	35.19	1210.0	1.07096
190.0	21.86	10.84	3267.0	5112.0	71.46	24.99	34.77	1233.0	1.06744
200.0	20.86	10.35	3524.0	5457.0	73.23	24.68	34.30	1257.0	1.06427
210.0	19.94	9.894	3776.0	5798.0	74.90	24.35	33.83	1280.0	1.06141
220.0	19.11	9.481	4024.0	6134.0	76.46	24.00	33.36	1304.0	1.05879
230.0	18.35	9.104	4268.0	6465.0	77.93	23.66	32.92	1327.0	1.05641
240.0	17.65	8.757	4508.0	6792.0	79.33	23.34	32.51	1350.0	1.05422
250.0	17.01	8.436	4745.0	7115.0	80.64	23.05	32.13	1372.0	1.05220
260.0	16.41	8.140	4978.0	7435.0	81.90	22.78	31.79	1395.0	1.05033
280.0	15.34	7.607	5436.0	8065.0	84.23	22.33	31.22	1438.0	1.04698
300.0	14.40	7.142	5884.0	8684.0	86.37	22.00	30.78	1479.0	1.04406
320.0	13.57	6.733	6326.0	9297.0	88.35	21.75	30.45	1519.0	1.04150
340.0	12.84	6.369	6763.0	9903.0	90.18	21.57	30.20	1557.0	1.03923
360.0	12.18	6.044	7196.0	10510.0	91.90	21.45	30.02	1594.0	1.03720
380.0	11.59	5.751	7626.0	11100.0	93.52	21.36	29.88	1630.0	1.03537
400.0	11.06	5.486	8055.0	11700.0	95.05	21.29	29.77	1665.0	1.03372

25.00 MPa isobar

20.53*	87.21	43.26	-574.7	3.2	10.93	10.68	13.93	1807.0	1.28773
25.0	84.99	42.16	-522.2	70.7	13.90	12.11	16.18	1747.0	1.27982
30.0	82.39	40.87	-454.9	156.8	17.03	12.95	18.18	1691.0	1.27054
35.0	79.63	39.50	-380.9	252.1	19.97	13.43	19.89	1641.0	1.26078
40.0	76.75	38.07	-301.4	355.3	22.72	13.72	21.39	1595.0	1.25062
60.0	64.83	32.16	54.3	831.6	32.32	14.60	25.88	1427.0	1.20919
70.0	59.19	29.36	247.6	1099.0	36.44	15.46	27.58	1355.0	1.18990
80.0	54.06	26.82	450.6	1383.0	40.23	16.72	29.16	1294.0	1.17251
90.0	49.51	24.56	664.3	1682.0	43.75	18.27	30.68	1249.0	1.15727
100.0	45.55	22.59	889.8	1996.0	47.06	19.94	32.13	1219.0	1.14409

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
110.0	42.11	20.89	1128.0	2324.0	50.18	21.55	33.43	1202.0	1.13274
120.0	39.14	19.41	1376.0	2664.0	53.14	22.95	34.51	1196.0	1.12297
130.0	36.54	18.13	1634.0	3013.0	55.93	24.04	35.28	1197.0	1.11451
140.0	34.27	17.00	1898.0	3369.0	58.57	24.82	35.77	1205.0	1.10714
150.0	32.28	16.01	2166.0	3728.0	61.04	25.30	35.97	1218.0	1.10069
160.0	30.51	15.13	2435.0	4087.0	63.36	25.52	35.95	1233.0	1.09498
170.0	28.93	14.35	2704.0	4446.0	65.54	25.52	35.74	1251.0	1.08992
180.0	27.51	13.65	2970.0	4802.0	67.57	25.37	35.40	1271.0	1.08538
190.0	26.23	13.01	3232.0	5154.0	69.47	25.12	34.98	1291.0	1.08130
200.0	25.07	12.44	3491.0	5501.0	71.26	24.81	34.51	1313.0	1.07761
210.0	24.02	11.91	3745.0	5844.0	72.93	24.46	34.03	1334.0	1.07426
220.0	23.05	11.43	3995.0	6182.0	74.50	24.11	33.56	1356.0	1.07120
230.0	22.16	10.99	4241.0	6515.0	75.98	23.77	33.11	1378.0	1.06839
240.0	21.34	10.59	4483.0	6844.0	77.38	23.44	32.69	1399.0	1.06581
250.0	20.58	10.21	4721.0	7169.0	78.71	23.14	32.30	1421.0	1.06342
260.0	19.88	9.862	4955.0	7490.0	79.97	22.88	31.96	1442.0	1.06120
280.0	18.61	9.234	5416.0	8123.0	82.32	22.42	31.37	1483.0	1.05723
300.0	17.51	8.684	5867.0	8746.0	84.46	22.08	30.92	1523.0	1.05375
320.0	16.53	8.198	6311.0	9361.0	86.45	21.83	30.57	1561.0	1.05069
340.0	15.65	7.765	6750.0	9969.0	88.29	21.65	30.31	1598.0	1.04797
360.0	14.87	7.377	7185.0	10570.0	90.02	21.51	30.12	1633.0	1.04554
380.0	14.17	7.027	7617.0	11170.0	91.64	21.42	29.97	1668.0	1.04334
400.0	13.53	6.710	8047.0	11770.0	93.18	21.35	29.85	1702.0	1.04136

30.00 MPa isobar

21.65*	88.58	43.94	-562.0	120.7	11.07	11.21	14.39	1881.0	1.29267
30.0	84.68	42.01	-458.9	255.3	16.30	13.02	17.66	1777.0	1.27871
40.0	79.58	39.48	-312.5	447.5	21.81	13.85	20.66	1686.0	1.26060
60.0	68.77	34.11	27.4	906.9	31.06	14.82	24.98	1535.0	1.22278
70.0	63.58	31.54	214.4	1166.0	35.04	15.68	26.76	1465.0	1.20489
80.0	58.76	29.15	412.7	1442.0	38.73	16.94	28.49	1403.0	1.18844
90.0	54.40	26.99	623.6	1735.0	42.18	18.48	30.18	1353.0	1.17368
100.0	50.51	25.06	847.9	2045.0	45.45	20.13	31.79	1317.0	1.16061
110.0	47.07	23.35	1085.0	2370.0	48.55	21.73	33.23	1294.0	1.14911
120.0	44.02	21.84	1335.0	2709.0	51.49	23.12	34.41	1281.0	1.13902
130.0	41.32	20.50	1594.0	3057.0	54.28	24.20	35.25	1277.0	1.13014
140.0	38.93	19.31	1859.0	3413.0	56.92	24.98	35.80	1280.0	1.12230
150.0	36.80	18.25	2129.0	3772.0	59.39	25.44	36.04	1288.0	1.11535
160.0	34.89	17.31	2400.0	4133.0	61.72	25.65	36.05	1300.0	1.10915
170.0	33.18	16.46	2670.0	4493.0	63.90	25.65	35.86	1315.0	1.10360
180.0	31.63	15.69	2938.0	4850.0	65.94	25.50	35.53	1332.0	1.09860
190.0	30.22	14.99	3202.0	5203.0	67.85	25.24	35.11	1350.0	1.09408
200.0	28.94	14.36	3462.0	5552.0	69.64	24.92	34.65	1369.0	1.08997
210.0	27.77	13.78	3718.0	5896.0	71.32	24.57	34.17	1389.0	1.08621
220.0	26.69	13.24	3969.0	6235.0	72.90	24.21	33.70	1409.0	1.08277
230.0	25.70	12.75	4217.0	6570.0	74.39	23.87	33.25	1429.0	1.07961
240.0	24.78	12.29	4460.0	6900.0	75.79	23.54	32.83	1449.0	1.07669
260.0	23.13	11.48	4935.0	7549.0	78.39	22.96	32.09	1489.0	1.07147
280.0	21.70	10.76	5398.0	8185.0	80.75	22.51	31.49	1528.0	1.06694
300.0	20.44	10.14	5851.0	8810.0	82.90	22.16	31.03	1566.0	1.06297
320.0	19.33	9.587	6297.0	9427.0	84.89	21.90	30.68	1603.0	1.05946
340.0	18.33	9.092	6738.0	10040.0	86.75	21.71	30.41	1638.0	1.05633
360.0	17.43	8.648	7174.0	10640.0	88.48	21.58	30.21	1672.0	1.05353
380.0	16.62	8.246	7608.0	11250.0	90.11	21.48	30.05	1706.0	1.05100
400.0	15.89	7.881	8039.0	11850.0	91.64	21.40	29.92	1739.0	1.04870

35.00 MPa isobar

22.72*	89.85	44.57	-548.4	236.9	11.21	11.69	14.75	1945.0	1.29722
30.0	86.71	43.01	-460.0	353.8	15.66	13.09	17.24	1854.0	1.28595

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
40.0	82.04	40.69	-319.2	540.9	21.02	13.95	20.08	1766.0	1.26931
60.0	72.08	35.75	8.4	987.4	30.02	15.00	24.30	1627.0	1.23427
70.0	67.24	33.35	190.1	1240.0	33.90	15.88	26.13	1561.0	1.21748
80.0	62.69	31.10	384.4	1510.0	37.51	17.14	27.94	1499.0	1.20185
90.0	58.52	29.03	592.6	1798.0	40.90	18.68	29.75	1448.0	1.18759
100.0	54.73	27.15	815.2	2104.0	44.13	20.32	31.46	1408.0	1.17476
110.0	51.32	25.45	1052.0	2427.0	47.20	21.90	33.00	1380.0	1.16330
120.0	48.26	23.94	1301.0	2764.0	50.13	23.29	34.26	1362.0	1.15308
130.0	45.52	22.58	1561.0	3111.0	52.91	24.35	35.17	1354.0	1.14397
140.0	43.05	21.36	1827.0	3466.0	55.54	25.12	35.77	1353.0	1.13584
150.0	40.84	20.26	2098.0	3825.0	58.02	25.58	36.05	1358.0	1.12855
160.0	38.84	19.27	2370.0	4186.0	60.35	25.78	36.08	1366.0	1.12200
170.0	37.03	18.37	2641.0	4546.0	62.53	25.78	35.92	1378.0	1.11609
180.0	35.38	17.55	2910.0	4904.0	64.57	25.62	35.60	1392.0	1.11074
190.0	33.88	16.81	3175.0	5258.0	66.49	25.35	35.20	1408.0	1.10587
200.0	32.50	16.12	3437.0	5608.0	68.28	25.03	34.75	1425.0	1.10142
210.0	31.24	15.50	3694.0	5953.0	69.97	24.67	34.27	1443.0	1.09734
220.0	30.07	14.92	3947.0	6293.0	71.55	24.31	33.80	1462.0	1.09358
230.0	28.99	14.38	4195.0	6629.0	73.04	23.96	33.35	1481.0	1.09012
240.0	27.99	13.88	4439.0	6960.0	74.45	23.63	32.93	1499.0	1.08691
260.0	26.19	12.99	4917.0	7611.0	77.06	23.05	32.19	1537.0	1.08116
280.0	24.61	12.21	5382.0	8249.0	79.42	22.59	31.59	1574.0	1.07615
300.0	23.22	11.52	5837.0	8876.0	81.58	22.23	31.12	1610.0	1.07174
320.0	21.98	10.90	6285.0	9494.0	83.58	21.97	30.76	1645.0	1.06783
340.0	20.88	10.36	6727.0	10110.0	85.44	21.78	30.49	1679.0	1.06434
360.0	19.88	9.861	7165.0	10710.0	87.17	21.64	30.28	1712.0	1.06120
380.0	18.97	9.412	7600.0	11320.0	88.81	21.54	30.12	1744.0	1.05836
400.0	18.15	9.004	8032.0	11920.0	90.35	21.46	29.99	1776.0	1.05578

40.00 MPa isobar

23.75 ^a	91.03	45.16	-533.8	352.0	11.37	12.12	15.04	2000.0	1.30149
30.0	88.53	43.91	-458.9	452.0	15.10	13.16	16.91	1925.0	1.29248
40.0	84.22	41.78	-322.6	634.8	20.34	14.04	19.60	1839.0	1.27706
60.0	74.94	37.17	-5.1	1071.0	29.12	15.16	23.77	1708.0	1.24428
70.0	70.39	34.92	172.2	1318.0	32.93	16.05	25.62	1646.0	1.22839
80.0	66.07	32.78	362.9	1583.0	36.47	17.32	27.50	1586.0	1.21346
90.0	62.06	30.79	568.4	1868.0	39.82	18.85	29.37	1533.0	1.19968
100.0	58.38	28.96	789.3	2171.0	43.01	20.49	31.17	1491.0	1.18713
110.0	55.03	27.30	1025.0	2491.0	46.05	22.06	32.78	1460.0	1.17578
120.0	51.99	25.79	1274.0	2825.0	48.97	23.44	34.10	1439.0	1.16554
130.0	49.23	24.42	1533.0	3171.0	51.74	24.50	35.07	1428.0	1.15633
140.0	46.74	23.18	1800.0	3525.0	54.36	25.26	35.71	1424.0	1.14802
150.0	44.47	22.06	2071.0	3884.0	56.84	25.71	36.03	1425.0	1.14052
160.0	42.41	21.04	2344.0	4245.0	59.16	25.90	36.09	1431.0	1.13372
170.0	40.53	20.11	2616.0	4605.0	61.35	25.89	35.94	1440.0	1.12755
180.0	38.81	19.25	2886.0	4963.0	63.39	25.73	35.64	1452.0	1.12192
190.0	37.24	18.47	3152.0	5318.0	65.31	25.46	35.25	1466.0	1.11677
200.0	35.79	17.75	3415.0	5668.0	67.11	25.13	34.81	1481.0	1.11205
210.0	34.45	17.09	3673.0	6014.0	68.80	24.77	34.34	1497.0	1.10770
220.0	33.21	16.47	3927.0	6355.0	70.38	24.41	33.88	1514.0	1.10369
240.0	30.99	15.37	4421.0	7024.0	73.29	23.72	33.01	1549.0	1.09653
260.0	29.05	14.41	4901.0	7676.0	75.90	23.13	32.27	1584.0	1.09032
280.0	27.35	13.57	5367.0	8315.0	78.27	22.66	31.67	1619.0	1.08488
300.0	25.85	12.82	5824.0	8944.0	80.44	22.30	31.20	1653.0	1.08008
320.0	24.51	12.16	6274.0	9564.0	82.44	22.04	30.84	1686.0	1.07582
340.0	23.30	11.56	6717.0	10180.0	84.30	21.84	30.56	1719.0	1.07200
360.0	22.21	11.02	7157.0	10790.0	86.04	21.70	30.35	1751.0	1.06855
380.0	21.22	10.53	7593.0	11390.0	87.68	21.59	30.18	1782.0	1.06543
400.0	20.32	10.08	8026.0	11990.0	89.22	21.51	30.04	1812.0	1.06259

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
50.00 MPa isobar									
25.71*	93.22	46.24	-502.4	578.9	11.70	12.78	15.43	2095.0	1.30939
30.0	91.71	45.49	-451.9	647.1	14.15	13.30	16.40	2049.0	1.30394
40.0	87.98	43.64	-322.5	823.3	19.20	14.16	18.81	1967.0	1.29050
100.0	64.50	31.99	752.3	2315.0	41.17	20.78	30.68	1640.0	1.20803
110.0	61.27	30.39	985.7	2631.0	44.18	22.35	32.39	1606.0	1.19699
120.0	58.31	28.92	1233.0	2962.0	47.06	23.71	33.81	1581.0	1.18688
130.0	55.58	27.57	1492.0	3306.0	49.81	24.75	34.85	1565.0	1.17763
140.0	53.07	26.32	1758.0	3658.0	52.42	25.50	35.56	1556.0	1.16918
150.0	50.76	25.18	2030.0	4015.0	54.89	25.94	35.93	1553.0	1.16144
160.0	48.64	24.13	2303.0	4376.0	57.21	26.13	36.03	1554.0	1.15435
170.0	46.68	23.16	2576.0	4735.0	59.39	26.10	35.92	1560.0	1.14784
180.0	44.88	22.26	2847.0	5093.0	61.44	25.93	35.66	1568.0	1.14185
190.0	43.20	21.43	3115.0	5448.0	63.36	25.65	35.29	1578.0	1.13632
200.0	41.65	20.66	3379.0	5799.0	65.16	25.32	34.87	1590.0	1.13121
220.0	38.86	19.28	3894.0	6487.0	68.44	24.58	33.96	1617.0	1.12207
240.0	36.43	18.07	4391.0	7158.0	71.36	23.88	33.11	1647.0	1.11414
260.0	34.29	17.01	4873.0	7813.0	73.98	23.28	32.38	1678.0	1.10720
280.0	32.40	16.07	5343.0	8454.0	76.36	22.80	31.78	1709.0	1.10107
300.0	30.71	15.23	5802.0	9085.0	78.53	22.43	31.31	1739.0	1.09563
320.0	29.19	14.48	6254.0	9707.0	80.54	22.16	30.95	1769.0	1.09076
340.0	27.82	13.80	6700.0	10320.0	82.41	21.96	30.67	1799.0	1.08638
360.0	26.58	13.18	7142.0	10930.0	84.15	21.81	30.45	1828.0	1.08241
380.0	25.45	12.62	7581.0	11540.0	85.80	21.70	30.28	1857.0	1.07880
400.0	24.41	12.11	8016.0	12150.0	87.35	21.61	30.14	1885.0	1.07550
60.00 MPa isobar									
27.56*	95.23	47.24	-468.6	801.6	12.03	13.24	15.66	2173.0	1.31667
40.0	91.16	45.22	-315.7	1011.0	18.27	14.23	18.18	2079.0	1.30194
60.0	83.78	41.56	-26.6	1417.0	26.45	15.57	22.29	1968.0	1.27549
80.0	76.33	37.86	317.8	1902.0	33.40	17.84	26.28	1863.0	1.24914
100.0	69.52	34.48	728.8	2469.0	39.70	21.02	30.30	1769.0	1.22536
110.0	66.42	32.95	959.9	2781.0	42.68	22.58	32.08	1734.0	1.21466
120.0	63.54	31.52	1206.0	3109.0	45.53	23.94	33.55	1707.0	1.20474
130.0	60.86	30.19	1463.0	3451.0	48.27	24.98	34.65	1688.0	1.19558
140.0	58.37	28.96	1729.0	3801.0	50.86	25.72	35.41	1676.0	1.18712
150.0	56.07	27.81	2000.0	4158.0	53.32	26.15	35.82	1670.0	1.17930
160.0	53.93	26.75	2274.0	4517.0	55.64	26.33	35.96	1669.0	1.17207
170.0	51.94	25.76	2547.0	4876.0	57.82	26.30	35.88	1671.0	1.16538
180.0	50.08	24.84	2819.0	5234.0	59.86	26.11	35.64	1677.0	1.15917
200.0	46.74	23.19	3352.0	5939.0	63.58	25.49	34.88	1694.0	1.14805
220.0	43.82	21.74	3868.0	6628.0	66.86	24.74	34.01	1717.0	1.13837
240.0	41.25	20.46	4368.0	7300.0	69.79	24.02	33.17	1742.0	1.12990
260.0	38.97	19.33	4852.0	7956.0	72.41	23.42	32.45	1769.0	1.12242
280.0	36.93	18.32	5324.0	8599.0	74.79	22.93	31.86	1796.0	1.11577
300.0	35.10	17.41	5785.0	9231.0	76.98	22.55	31.39	1824.0	1.10982
320.0	33.45	16.59	6239.0	9855.0	78.99	22.27	31.03	1851.0	1.10447
340.0	31.95	15.85	6687.0	10470.0	80.86	22.07	30.75	1878.0	1.09963
360.0	30.58	15.17	7131.0	11090.0	82.61	21.91	30.53	1905.0	1.09523
380.0	29.33	14.55	7571.0	11690.0	84.26	21.79	30.35	1931.0	1.09122
400.0	28.18	13.98	8008.0	12300.0	85.81	21.70	30.21	1958.0	1.08753
80.00 MPa isobar									
31.01*	98.89	49.05	-395.9	1235.0	12.64	13.78	15.93	2299.0	1.33000
40.0	96.41	47.83	-289.3	1383.0	16.84	14.27	17.23	2262.0	1.32098
60.0	90.26	44.77	-19.0	1768.0	24.58	15.76	21.23	2171.0	1.29869
80.0	83.73	41.53	308.4	2235.0	31.26	18.16	25.48	2075.0	1.27533
100.0	77.53	38.46	707.2	2787.0	37.41	21.39	29.73	1987.0	1.25339
120.0	71.93	35.68	1176.0	3418.0	43.15	24.31	33.16	1923.0	1.23376
140.0	66.96	33.21	1695.0	4104.0	48.43	26.08	35.16	1888.0	1.21651

Thermophysical properties of hydrogen—Continued

T K	Density kg/m ³	Density mol/dm ³	E J/mol	H J/mol	S J/(mol·K)	C _v J/(mol·K)	C _p J/(mol·K)	Sound m/s	Diel. const.
160.0	62.56	31.03	2238.0	4815.0	53.18	26.66	35.82	1874.0	1.20141
180.0	58.69	29.11	2782.0	5530.0	57.40	26.43	35.57	1875.0	1.18817
200.0	55.25	27.41	3316.0	6235.0	61.11	25.78	34.88	1885.0	1.17653
220.0	52.19	25.89	3834.0	6925.0	64.39	25.01	34.04	1902.0	1.16623
240.0	49.45	24.53	4336.0	7597.0	67.32	24.28	33.23	1921.0	1.15707
260.0	46.99	23.31	4823.0	8255.0	69.95	23.66	32.53	1942.0	1.14888
280.0	44.77	22.21	5297.0	8899.0	72.34	23.16	31.95	1964.0	1.14151
300.0	42.76	21.21	5761.0	9533.0	74.53	22.77	31.50	1986.0	1.13485
320.0	40.92	20.30	6218.0	10160.0	76.55	22.48	31.14	2009.0	1.12881
340.0	39.23	19.46	6669.0	10780.0	78.43	22.26	30.86	2031.0	1.12329
360.0	37.69	18.70	7115.0	11390.0	80.19	22.10	30.64	2053.0	1.11824
380.0	36.26	17.99	7558.0	12010.0	81.84	21.97	30.46	2076.0	1.11360
400.0	34.94	17.33	7998.0	12610.0	83.40	21.87	30.32	2098.0	1.10931
100.00 MPa isobar									
34.18 ^a	102.2	50.72	-318.8	1653.0	13.17	14.06	16.19	2389.0	1.34230
40.0	100.8	49.99	-252.1	1748.0	15.74	14.23	16.67	2394.0	1.33694
60.0	95.43	47.34	4.3	2117.0	23.16	15.81	20.37	2339.0	1.31740
80.0	89.61	44.45	318.0	2568.0	29.62	18.35	24.81	2253.0	1.29635
100.0	83.89	41.61	706.2	3109.0	35.64	21.65	29.28	2167.0	1.27588
120.0	78.59	38.98	1168.0	3733.0	41.32	24.59	32.87	2105.0	1.25709
140.0	73.79	36.60	1682.0	4414.0	46.56	26.36	34.97	2068.0	1.24026
160.0	69.49	34.47	2222.0	5123.0	51.29	26.94	35.71	2052.0	1.22528
180.0	65.64	32.56	2765.0	5836.0	55.49	26.69	35.52	2049.0	1.21197
200.0	62.18	30.85	3298.0	6540.0	59.20	26.03	34.86	2056.0	1.20010
220.0	59.07	29.30	3817.0	7229.0	62.49	25.24	34.05	2069.0	1.18948
240.0	56.26	27.91	4319.0	7903.0	65.42	24.50	33.27	2084.0	1.17993
260.0	53.70	26.64	4807.0	8561.0	68.05	23.87	32.58	2101.0	1.17131
280.0	51.37	25.48	5283.0	9207.0	70.45	23.35	32.02	2120.0	1.16349
300.0	49.25	24.43	5749.0	9842.0	72.64	22.96	31.57	2138.0	1.15637
320.0	47.29	23.46	6207.0	10470.0	74.66	22.66	31.21	2157.0	1.14986
340.0	45.49	22.56	6660.0	11090.0	76.55	22.43	30.94	2176.0	1.14388
360.0	43.82	21.74	7108.0	11710.0	78.31	22.26	30.72	2195.0	1.13838
380.0	42.28	20.97	7553.0	12320.0	79.97	22.12	30.54	2214.0	1.13329
400.0	40.84	20.26	7994.0	12930.0	81.53	22.02	30.40	2234.0	1.12857
120.00 MPa isobar									
37.14 ^a	105.4	52.30	-239.0	2056.0	13.57	14.29	16.67	2449.0	1.35403
60.0	99.79	49.50	37.1	2461.0	22.02	15.76	19.67	2480.0	1.33331
100.0	89.19	44.24	718.0	3430.0	34.19	21.82	28.87	2325.0	1.29485
120.0	84.15	41.74	1173.0	4048.0	39.81	24.81	32.62	2262.0	1.27680
140.0	79.51	39.44	1682.0	4724.0	45.02	26.58	34.82	2226.0	1.26036
160.0	75.30	37.35	2218.0	5431.0	49.74	27.16	35.63	2208.0	1.24555
180.0	71.50	35.47	2760.0	6143.0	53.93	26.91	35.49	2205.0	1.23225
200.0	68.05	33.75	3292.0	6847.0	57.64	26.24	34.86	2210.0	1.22028
220.0	64.92	32.20	3810.0	7537.0	60.93	25.44	34.07	2220.0	1.20947
240.0	62.06	30.79	4313.0	8210.0	63.86	24.69	33.31	2233.0	1.19969
260.0	59.46	29.49	4801.0	8869.0	66.50	24.05	32.63	2248.0	1.19080
280.0	57.07	28.31	5277.0	9516.0	68.90	23.53	32.07	2264.0	1.18268
300.0	54.87	27.22	5744.0	10150.0	71.09	23.12	31.63	2280.0	1.17525
320.0	52.84	26.21	6204.0	10780.0	73.12	22.81	31.28	2296.0	1.16841
340.0	50.96	25.28	6658.0	11400.0	75.01	22.58	31.01	2312.0	1.16210
360.0	49.21	24.41	7107.0	12020.0	76.78	22.40	30.79	2329.0	1.15626
380.0	47.58	23.60	7553.0	12640.0	78.44	22.26	30.61	2345.0	1.15084
400.0	46.07	22.85	7996.0	13250.0	80.00	22.15	30.47	2363.0	1.14579

^aAt melting line.^bAt liquid-vapor boundary.

Coefficients for Parahydrogen

Parahydrogen Coefficients for MBWR eq

$$\begin{aligned}
 G(1) &= .4675528393416 \times 10^4 \\
 G(2) &= .4289274251454 \times 10^2 \\
 G(3) &= -.5164085596504 \times 10^{-1} \\
 G(4) &= .2961790279801 \\
 G(5) &= -.3027194968412 \times 10^1 \\
 G(6) &= .1908100320379 \times 10^{-5} \\
 G(7) &= -.1339776859288 \times 10^{-3} \\
 G(8) &= .3056473115421 \times 10^{-1} \\
 G(9) &= .5161197159532 \times 10^1 \\
 G(10) &= .1999981550224 \times 10^{-7} \\
 G(11) &= .2896367059356 \times 10^4 \\
 G(12) &= -.2257803939041 \times 10^2 \\
 G(13) &= -.2287392761826 \times 10^{-6} \\
 G(14) &= .2446261478645 \times 10^{-3} \\
 G(15) &= -.1718181601119 \times 10^{-3} \\
 G(16) &= -.5465142603459 \times 10^{-7} \\
 G(17) &= .4051941401315 \times 10^{-9} \\
 G(18) &= .1157595123961 \times 10^{-6} \\
 G(19) &= -.1269162728389 \times 10^{-8} \\
 G(20) &= -.4983023605519 \times 10^1 \\
 G(21) &= -.1606676092098 \times 10^2 \\
 G(22) &= -.1926799185310 \times 10^{-1} \\
 G(23) &= .9319894638928 \\
 G(24) &= -.3222596554434 \times 10^4 \\
 G(25) &= .1206839307669 \times 10^{-3} \\
 G(26) &= -.3841588197470 \times 10^{-7} \\
 G(27) &= -.4036157453608 \times 10^{-5} \\
 G(28) &= -.1250868123513 \times 10^{-10} \\
 G(29) &= .1976107321888 \times 10^{-9} \\
 G(30) &= -.2411883474011 \times 10^{-13} \\
 G(31) &= -.4127551498251 \times 10^{-13} \\
 G(32) &= .8917972883610 \times 10^{-12} \\
 \gamma &= -.0041
 \end{aligned}$$

Parahydrogen Coefficients for Vapor Pressure

$$\begin{aligned}
 V_p(1) &= 3.05300134164 & V_p(2) &= 2.80810925813 \\
 V_p(3) &= -0.655461216567 & V_p(5) &= 1.59514439374 \\
 V_p(6) &= 1.5814454428 & V_p(9) &= 0.0070420875 \\
 V_p(7) &= 13.8 & V_p(8) &= 32.938 \\
 V_p(4) &= 0.0
 \end{aligned}$$

Parahydrogen Coefficients Saturated Liquid and Vapor Densities

$$\begin{aligned}
 A(1) &= .916617720187 \times 10^2 \\
 A(2) &= -.179492524446 \\
 A(3) &= .454671158395 \times 10^1 \\
 A(4) &= -.658499589788 \times 10^2 \\
 A(5) &= .734466804535 \times 10^3 \\
 A(6) &= -.682501045175 \times 10^3 \\
 A(7) &= .631783674710 \times 10^3 \\
 A(8) &= -.539408873282 \times 10^3 \\
 A(9) &= .430923811783 \times 10^3 \\
 A(10) &= -.300295738811 \times 10^3 \\
 A(11) &= .156567165346 \times 10^3 \\
 A(12) &= -.504103608225 \times 10^2 \\
 A(13) &= .720706926514 \times 10^1 \\
 A(14) &= -.123944440318 \times 10^3 \\
 A(15) &= .140334800142 \times 10^1 \\
 A(16) &= -.211023804313 \times 10^2 \\
 A(17) &= .173254622817 \times 10^3 \\
 A(18) &= -.444294580871 \times 10^3 \\
 A(19) &= .138699365355 \times 10^3 \\
 A(20) &= -.235774161015 \times 10^2
 \end{aligned}$$

Parahydrogen Coefficients for Ideal Gas C_p for Temperatures > 140 K

$$\begin{aligned}
 G(1) &= .5262185164597 \times 10^8 \\
 G(2) &= -.1487906248823 \times 10^7 \\
 G(3) &= .1601391392264 \times 10^6 \\
 G(4) &= -.8031235938946 \times 10^2 \\
 G(5) &= .2307407941873 \\
 G(6) &= -.3176386248370 \times 10^{-3} \\
 G(7) &= .1643857271214 \times 10^{-6} \\
 G(8) &= .9230816464058 \times 10^1 \\
 G(9) &= .3 \times 10^4
 \end{aligned}$$

Parahydrogen Coefficients for Ideal Gas C_p for Temperatures < 22 K

$$\begin{aligned}
 G(1) &= 0.0 \\
 G(2) &= 0.0 \\
 G(3) &= 0.0 \\
 G(4) &= 2.5000315 \\
 G(5) &= 0.0 \\
 G(6) &= 0.0 \\
 G(7) &= 0.0 \\
 G(8) &= 0.0 \\
 G(9) &= 0.0
 \end{aligned}$$

Parahydrogen Coefficients for Ideal Gas C_p for Temperatures $40 < T < 140$ K

$$\begin{aligned}
 G(1) &= .2905965792270 \times 10^6 \\
 G(2) &= -.2831103639248 \times 10^5 \\
 G(3) &= .1050424877391 \times 10^4 \\
 G(4) &= -.1535751501769 \times 10^2 \\
 G(5) &= .1218941696566 \\
 G(6) &= -.2599406479908 \times 10^{-4} \\
 G(7) &= -.1288757333406 \times 10^{-5} \\
 G(8) &= .1717441975231 \times 10^6 \\
 G(9) &= .3 \times 10^4
 \end{aligned}$$

Parahydrogen Coefficients for Melting Pressure for Temperatures < 22 K

$$\begin{aligned}
 A &= -21.281484395 \\
 B &= .125746643 \\
 C &= 1.955
 \end{aligned}$$

Parahydrogen Coefficients for Melting Pressure for Temperatures > 22 K

$$\begin{aligned}
 A &= -26.5289115 \\
 B &= .248578596 \\
 C &= 1.764739
 \end{aligned}$$

Parahydrogen Coefficients for Dielectric Constant

$$\begin{aligned}
 A &= .20245443 \times 10^{-2} \\
 B &= .37171832 \times 10^{-6} \\
 C &= -.92085013 \times 10^{-8} \\
 D &= -.34065328 \times 10^{-11} \\
 E &= .0 \\
 F &= .0
 \end{aligned}$$