

Radon (Rn)

REFERENCE STATE

0 to 6000 K Ideal Monatomic Gas

$IP(\text{Rn}, g) = 86692.5 \pm 0.2 \text{ cm}^{-1}$   
 $S^\circ(298.15 \text{ K}) = 176.235 \pm 0.003 \text{ J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}$

$\Delta H_f^\circ(0 \text{ K}) = 0 \text{ kJ} \cdot \text{mol}^{-1}$   
 $\Delta H_f^\circ(298.15 \text{ K}) = 0 \text{ kJ} \cdot \text{mol}^{-1}$

Electronic Levels and Quantum Weights State	$\epsilon_i, \text{cm}^{-1}$	$g_i$
$^1S_0$	0	1

Heat of Formation  
Zero by definition.

Heat Capacity and Entropy

Information on the electronic energy levels and quantum weights is taken from Moore.<sup>13</sup> Many of the theoretically predicted levels have not been observed. Our calculations indicate that any reasonable method of filling in these missing levels and cutting off the summation in the partition function<sup>2</sup> has little effect on the thermodynamic properties to 6000 K. This is undoubtedly a result of the high energy of these levels; the first excited level is over 54620  $\text{cm}^{-1}$  above the ground state. Therefore, we list the ground state only. Extension to higher temperatures may require consideration of excited states and utilization of different fill and cutoff procedures.<sup>2</sup>

Thermodynamic functions at 298.15 K are recommended by CODATA<sup>3</sup> for all rare gases except radon. This table agrees with other tabulations except for two minor changes. First, the entropy differs by  $0.1094 \text{ J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}$  because this table uses a reference pressure of 1 bar, whereas the other tabulations are based on 1 atm. Second, entropy differences of the order of  $0.001\text{--}0.004 \text{ J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}$  for the rare gases arise due to the use of slightly different values for R and the relative atomic mass; this table uses  $R = 8.31441 \text{ J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}$ . With some minor changes, our tables agree within the estimated uncertainty with those by Hilsenrath *et al.*,<sup>5</sup> Gurvich *et al.*,<sup>6</sup> and Wagman *et al.*<sup>10</sup> The estimated uncertainty is due to uncertainties in the relative atomic mass and fundamental constants which are based on the 1981 scale<sup>6</sup> and the 1973 values,<sup>7</sup> respectively.

Phase Data

Hullgren *et al.*<sup>4</sup> had recommended a melting point of 202 K and a boiling point of 211 K (1 atm). These values are provided for the convenience of the reader and have not been evaluated by the present authors. As a result of the low values, the reference state for radon is chosen to be the ideal gas at all temperatures. This may differ from the choice of other authors.

References

- C. E. Moore, U. S. Nat. Bur. Stand., NSRDS-NBS-35, Volume III, (1970) [Reprint of NBS Circular 467, Volume III, 1958].
- J. R. Downey, Jr., The Dow Chemical Co., AFOSR-TR-78-0960, Contract No. F44620-75-1-0048, (1978).
- J. D. Cox, ICSU-CODATA Task Group, J. Chem. Thermodyn. 10, 903 (1978).
- R. Hullgren, P. D. Dessai *et al.*, "Selected Values of the Thermodynamic Properties of the Elements," American Society for Metals, Metals Park, Ohio, (1973).
- J. Hilsenrath, C. G. Messina and W. H. Evans, U.S. Nat. Bur. Stand., Report AD-606163 (avail. NTIS), (1964).
- N. E. Holden and R. L. Martin, Pure Appl. Chem. 51, 405 (1979).
- E. R. Cohen and B. N. Taylor, J. Phys. Chem. Ref. Data 2, 663 (1973).
- L. V. Gurvich, I. V. Veits *et al.*, "Thermodynamic Properties of Individual Substances," 3rd ed., Volume I, Nauka, Moscow, (1978).
- C. E. Moore, U. S. Nat. Bur. Stand., NSRDS-NBS-34, 8 pp (1970).
- D. D. Wagman, W. H. Evans *et al.*, J. Phys. Chem. Ref. Data 11, Supp. 2, 44 (1982).

A<sub>r</sub> = 222 Radon (Rn)

T/K	C <sub>p</sub> <sup>o</sup>	Enthalpy Reference Temperature = T <sub>r</sub> = 298.15 K		Standard State Pressure = P <sup>o</sup> = 0.1 MPa		Rn <sub>1</sub> (ref)
		S <sup>o</sup> - (C <sub>p</sub> <sup>o</sup> - H <sup>o</sup> (T <sub>r</sub> ))/T	H <sup>o</sup> - H <sup>o</sup> (T <sub>r</sub> )	Δ <sub>r</sub> H <sup>o</sup>	Δ <sub>r</sub> G <sup>o</sup>	
0	0	INFINITE	-6.197	0	0	0
100	20.786	153.527	194.715	0	0	0
200	20.786	167.935	178.136	0	0	0
250	20.786	172.574	176.577	0	0	0
298.15	20.786	176.235	176.235	0	0	0
300	20.786	176.363	176.235	0.038	0	0
350	20.786	179.567	176.488	1.078	0	0
400	20.786	182.343	177.050	2.117	0	0
450	20.786	184.791	177.777	3.156	0	0
500	20.786	186.981	178.590	4.196	0	0
600	20.786	190.771	180.314	6.274	0	0
700	20.786	193.975	182.043	8.353	0	0
800	20.786	196.751	183.711	10.431	0	0
900	20.786	199.199	185.299	12.510	0	0
1000	20.786	201.389	186.800	14.589	0	0
1100	20.786	203.370	188.218	16.667	0	0
1200	20.786	205.179	189.557	18.746	0	0
1300	20.786	206.843	190.824	20.824	0	0
1400	20.786	208.383	192.024	22.903	0	0
1500	20.786	209.817	193.163	24.982	0	0
1600	20.786	211.159	194.246	27.060	0	0
1700	20.786	212.419	195.278	29.139	0	0
1800	20.786	213.607	196.264	31.217	0	0
1900	20.786	214.731	197.206	33.296	0	0
2000	20.786	215.797	198.110	35.375	0	0
2100	20.786	216.811	198.976	37.453	0	0
2200	20.786	217.778	199.809	39.532	0	0
2300	20.786	218.702	200.610	41.610	0	0
2400	20.786	219.587	201.383	43.689	0	0
2500	20.786	220.435	202.128	45.768	0	0
2600	20.786	221.250	202.848	47.846	0	0
2700	20.786	222.035	203.544	49.925	0	0
2800	20.786	222.791	204.218	52.004	0	0
2900	20.786	223.520	204.871	54.082	0	0
3000	20.786	224.225	205.505	56.161	0	0
3100	20.786	224.906	206.120	58.239	0	0
3200	20.786	225.566	206.717	60.318	0	0
3300	20.786	226.206	207.298	62.397	0	0
3400	20.786	226.826	207.863	64.475	0	0
3500	20.786	227.429	208.414	66.554	0	0
3600	20.786	228.015	208.950	68.632	0	0
3700	20.786	228.584	209.473	70.711	0	0
3800	20.786	229.138	209.983	72.790	0	0
3900	20.786	229.678	210.481	74.868	0	0
4000	20.786	230.205	210.968	76.947	0	0
4100	20.786	230.718	211.443	79.025	0	0
4200	20.786	231.219	211.908	81.104	0	0
4300	20.786	231.708	212.363	83.183	0	0
4400	20.786	232.186	212.808	85.261	0	0
4500	20.786	232.653	213.244	87.340	0	0
4600	20.786	233.110	213.671	89.418	0	0
4700	20.786	233.557	214.089	91.497	0	0
4800	20.786	233.994	214.609	93.576	0	0
4900	20.786	234.423	215.102	95.654	0	0
5000	20.786	234.843	215.256	97.733	0	0
5100	20.786	235.255	215.684	99.811	0	0
5200	20.786	235.658	216.064	101.890	0	0
5300	20.786	236.054	216.437	103.969	0	0
5400	20.786	236.443	216.804	106.047	0	0
5500	20.786	236.824	217.165	108.126	0	0
5600	20.786	237.199	217.519	110.204	0	0
5700	20.786	237.566	217.868	112.283	0	0
5800	20.786	237.928	218.210	114.362	0	0
5900	20.786	238.283	218.548	116.440	0	0
6000	20.786	238.633	218.879	118.519	0	0

PREVIOUS:

CURRENT: March 1982 (1 bar)

Radon (Rn)

Rn<sub>1</sub>(ref)

