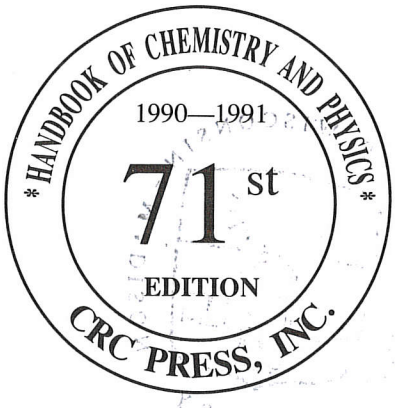
CRC Handbook of Chemistry and Physics

A Ready-Reference Book of Chemical and Physical Data



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ATOMIC WEIGHTS, MELTING AND BOILING POINTS OF THE ELEMENTS (CONTINUED)

Name	Symbol	Atomic number	Atomic weight	Footnotes	Melting point (°C)	Boiling point (°C)
Radium	Ra	88	226.025	g, L	700	1140
Radon	Rn	86	(222)		–71	–61.8
Rhenium	Re	75	186.207(1)		3180	5627 (est.)
Rhodium	Rh	45	102.90550(3)		1965 ± 3	3727 ± 100
Rubidium	Rb	37	85.4678(3)	g	38.89	686
Ruthenium	Ru	44	101.07(2)	g	2310	3900
Samarium	Sm	62	150.36(3)	g	1074	1794
Scandium	Sc	21	44.955910(9)		1541	2836
Selenium	Se	34	78.96(3)		217	684.9 ± 1.0
Silicon	Si	14	28.0855(3)		1410	2355
Silver (Argentum)	Ag	47	107.8682(2)	g	961.93	2212
Sodium (Natrium)	Na	11	22.989768(6)		97.81 ± 0.03	882.9
Strontium	Sr	38	87.62(1)	g	769	1384
Sulfur	S	16	32.066(6)	r	112.8	444.674
Tantalum	Ta	73	180.9479(1)		2996	5425 ± 100
Technetium	Tc	43	(98)		2172	4877
Tellurium	Te	52	127.60(3)	g	449.5 ± 0.3	989.8 ± 3.8
Terbium	Tb	65	158.92534(3)		1356	3230
Thallium	Tl	81	204.3833(2)		303.5	1457 ± 10
Thorium	Th	90	232.0381(1)	g, L	1750	3800 (approx.)
Thullium	Tm	69	168.93421(3)		1545	1950
Tin (Stannum)	Sn	50	118.710(7)		231.9681	2270
Titanium	Ti	22	47.88(3)		1660 ± 10	3287
Tungsten (Wolfram)	W	74	183.85(3)		3410 ± 20	5660
Unnihexium	(Unh)	106	(263)			
Unnilpentium	(Unp)	105	(262)			
Unnilquadium	(Unq)	104	(261)			
Unnilseptium	(Uns)	107	(262)			
Uranium	U	92	238.0289(1)	g, m	1132 ± 0.8	3818
Vanadium	V	23	50.9415(1)		1890 ± 10	3380
Wolfram (see Tungsten)						
Xenon	Xe	54	131.29(2)	g, m	–111.9	–107.1 ± 3
Ytterbium	Yb	70	173.04(3)		819	1196
Yttrium	Y	39	88.90585(2)		1552	5338
Zinc	Zn	30	65.39(2)		419.58	907
Zirconium	Zr	40	91.224(2)	g	1852 ± 2	4377

g geological exceptional specimens are known in which the element has an isotopic composition outside the limits for normal material. The difference between the atomic weight of the element in such specimens and that given in the Table may exceed considerably the implied uncertainty.

m modified isotopic compositions may be found in commercially available material because it has been subjected to an undisclosed or inadvertent isotopic separation. Substantial deviations in atomic weight of the element from that given in the Table can occur.

r range in isotopic composition of normal terrestrial material prevents a more precise atomic weight being given; the tabulated A_r(E) value should be applicable to any normal material.

t Triple point; (graphite-liquid-gas), 3627 ± 50°C at a pressure of 10.1 MPa and (graphite-diamond-liquid), 3830 to 3930°C at a pressure of 12 to 13 GPa.

L Longest half-life isotope mass is chosen for the tabulated Ar (E) value.

SPECIFIC HEAT AND ENTHALPY OF SOME SOLIDS AT LOW TEMPERATURES

R. J. Corruccini and J. J. Gniewek

For a more extensive listing of data one is referred to N.B.S. Monograph 21 (1960)

Joules/g × 453.6 = joules/lb × 0.239 = cal/g × 0.4299 = Btu/lb

Metals

	Aluminum		Beryllium		Bismuth		Cadmium	
T	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$
°K	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}
1	0.00010[a]	—	—	—	—	—	—	—
1	0.000051	0.000025	0.000025	0.000013	0.00000598	0.00000158	0.000008	0.000003
2	0.000108	0.000105	0.000051	0.000051	0.0000461	0.0000233	0.000033	0.000022
3	0.000176	0.000246	0.000079	0.000116	0.000170	0.000123	0.000090	0.000082
4	0.000261	0.000463	0.000109	0.000209	0.000493	0.000432	0.00021	0.00022
6	0.00050	0.00121	0.000180	0.000496	0.00214	0.00288	0.00130	0.0015
8	0.00088	0.0026	0.000271	0.000944	0.00547	0.0102	0.0043	0.0070
10	0.0014	0.0049	0.000389	0.00160	0.0104	0.0259	0.0080	0.109
15	0.0040	0.018	0.000842	0.00457	0.0238	0.111	0.025	0.102
20	0.0089	0.048	0.00161	0.0105	0.0363	0.262	0.046	0.28
25	0.0175	0.112	0.00279	0.0212	0.0477	0.472	0.066	0.56
30	0.0315	0.232	0.00450	0.0392	0.0572	0.734	0.086	0.94
35	0.0515	0.436	—	—	—	—	—	—
40	0.0775	0.755	0.00996	0.109	0.0727	1.38	0.117	1.96
50	0.142	1.85	0.0192	0.253	0.0846	2.17	0.141	3.26
60	0.214	3.64	0.0341	0.523	0.0935	3.06	0.159	4.76
70	0.287	6.15	0.0562	0.971	0.100	4.03	0.172	6.43
80	0.357	9.37	0.0906	1.69	0.105	5.05	0.182	8.20
90	0.422	13.25	0.139	2.82	0.108	6.12	0.190	10.1
100	0.481	17.76	0.199	4.51	0.111	7.21	0.196	12.0

	Chromium		Copper		Germanium[b]		Gold	
T	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$
°K	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}	$g^{-1}\ deg^{-1}\ K$	jg^{-1}	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}
1	0.0000285	0.0000142	0.000012	0.000006	0.000000528	0.000000132	0.000006	0.000002
2	0.000058	0.0000573	0.000028	0.000025	0.00000423	0.00000211	0.000025	0.000016
3	0.000089	0.000131	0.000053	0.000064	0.0000144	0.0000107	0.000070	0.000061
4	0.00014	0.000237	0.000091	0.00013	0.0000344	0.0000343	0.00016	0.00017
6	0.000206	0.000567	0.00023	0.00044	0.000125	0.000179	0.00050	0.00078
6	0.000206	0.000567	0.00023	0.00044	0.000125	0.000179	0.00050	0.00078
8	0.000312	0.00107	0.00047	0.00112	0.000335	0.000612	0.0012	0.0024
10	0.000451	0.00182	0.00086	0.0024	0.000813	0.00169	0.0022	0.0056
15	0.00102	0.00528	0.0027	0.0107	0.00445	0.0136	0.0074	0.028
20	0.00210	0.0128	0.0077	0.034	0.0125	0.0540	0.0159	0.086
25	0.00392	0.0274	0.016	0.090	0.0240	0.145	0.0263	0.191
30	0.00683	0.0532	0.027	0.195	0.0366	0.296	0.0371	0.349
40	0.0171	0.163	0.060	0.61	0.0617	0.786	0.0572	0.821
50	0.0358	0.421	0.099	1.40	0.0858	1.52	0.0726	1.47
60	0.0621	0.904	0.137	2.58	0.108	2.50	0.0842	2.25
70	0.093	1.68	0.173	4.13	0.131	3.70	0.0928	3.14
80	0.127	2.77	0.205	6.02	0.153	5.12	0.0992	4.10
90	0.161	4.21	0.232	8.22	0.173	6.74	0.1043	5.12
100	0.193	5.98	0.254	10.6	0.191	8.55	0.1083	6.18

	Indium		α-Iron[c]		γ-Iron[d]		Lead	
T	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$
°K	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}	$jg^{-1}\ deg^{-1}\ K$	jg^{-1}
1	0.000029	0.000011	0.000090	0.000045	—	—	0.000026	0.000010
1	0.000019[a]	0.000006[a]	—	—	—	—	0.000012[a]	0.000003[a]
2	0.000138	0.000085	0.000183	0.000181	—	—	0.00012	0.00007
2	0.000141[a]	0.000073[a]	—	—	—	—	0.00009[a]	0.00005[a]
								0.00028
3	0.000410	0.000341	0.000279	0.000412	—	—	0.00033	0.00023[a]
3	0.000464[a]	0.000357[a]	—	—	—	—	0.00031[a]	
3.40[e]	0.000584	0.000537	—	—	—	—	—	—
3.40	0.000669[a]	0.000581[a]	—	—	—	—	—	—
4	0.00095	0.00099	0.000382	0.000742	—	—	0.0007	0.0008
4	—	—	—	—	—	—	0.0007[a]	0.0007[a]
5	—	—	—	—	—	—	0.0015	0.0018
5	—	—	—	—	—	—	0.0015[a]	0.0018[a]
6	0.00359	0.00520	0.000615	0.00173	—	—	0.0029	0.0039
6	—	—	—	—	—	—	0.0030[a]	0.0040[a]
7	—	—	—	—	—	—	0.0048	0.008

SPECIFIC HEAT AND ENTHALPY OF SOME SOLIDS AT LOW TEMPERATURES (continued)

T	Chromium		Copper		Germanium[b]		Gold	
	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$
°K	jg^{-1} deg^{-1} K	jg^{-1}	jg^{-1} deg^{-1} K	jg^{-1}	g^{-1} deg^{-1} K	jg^{-1}	jg^{-1} deg^{-1} K	jg^{-1}
7	—	—	—	—	—	—	0.0050[a]	0.008[a]
8	0.00855	0.0170	0.00090	0.003233	—	—	0.0073	0.014
10	0.0155	0.0408	0.00124	0.00537	—	—	0.0137	0.034
15	0.036	0.170	0.00249	0.0145	—	—	0.0335	0.150
20	0.0608	0.413	0.0045	0.0316	0.007	0	0.0531	0.368
25	0.0857	0.778	0.0075	0.061	—	—	0.0681	0.672
30	0.108	1.265	0.0124	0.110	0.016	0.11	0.0796	1.042
40	0.141	2.52	0.029	0.31	0.041	0.39	0.0944	1.920
50	0.162	4.04	0.055	0.73	0.090	1.0^{2}	0.103	2.91
60	0.176	5.73	0.087	1.43	0.13^{7}	2.1^{6}	0.108	3.97
70	0.186	7.53	0.121	2.46	0.18^{0}	3.7^{5}	0.112	5.07
80	0.193	9.42	0.154	3.84	0.21^{8}	5.74^{4}	0.114	6.20
90	0.198	11.38	0.186	5.55	0.25^{5}	8.1^{1}	0.116	7.35
100	0.203	13.39	0.216	7.56	0.28^{8}	10^{8}	0.118	853

T	Molybdenum		Nickel		Palladium	
	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$
°K	jg^{-1} deg^{-1} K	$jgum^{1}$	jg^{-1} deg^{-1} K	jg^{-1}	jg^{-1} deg^{-1} K	jg^{-1}
1	0.0000229	0.0000105	0.000120	0.000060	0.000099	0.0000493
2	0.0000472	0.0000445	0.000242	0.000241	0.000203	0.000200
2	—	—	—	—	—	—
3	0.0000745	0.000105	0.000369	0.000546	0000318	0.000459
3	—	—	—	—	—	—
4	0.000106	0.000194	0.000503	0.00098	0.000447	0.000840
4	—	—	—	—	—	—
5	—	—	—	—	—	—
5	—	—	—	—	—	—
6	0.000191	0.000484	0.00082	0.00228	0.000891	0.00231
6	—	—	—	—	—	—
7	—	—	—	—	—	—
7	—	—	—	—	—	—
8	0.000317	0.000981	0.00119	0.00428	0.00141	0.00460
8	—	—	—	—	—	—
9	—	—	—	—	—	—
9	—	—	—	—	—	—
10	0.000498	0.00178	0.00162	0.0071	0.00210	0.00807
15	0.00131	0.00610	0.0031	0.0185	0.00471	0.0245
20	0.00287	0.0161	0.0058	0.041	0.00922	0.0586
25	0.00577	0.0374	0.0101	0.079	0.0160	0.120
30	0.00960	0.0729	0.0167	0.145	0.0258	0.223
40	0.0236	0.232	0.0381	0.413	0.0507	0.600
50	0.0410	0.554	0.0682	0.937	0.0777	1.24
60	0.0619	1.07	0.103	1.79	0.101	2.14
70	0.0838	1.80	0.139	3.00	0.122	3.26
80	0.104	2.74	0.173	4.56	0.139	4.56
90	0.123	3.88	0.204	6.45	0.154	6.03
100	0.139	5.20	0.232	8.63	0.167	7.63

T	Platinum		Rhodium		Silicon[1]		Silver	
	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$	C_p	$H - H_o$
°K	jg^{-1} deg^{-1} K	jg^{-1}	jg^{-1} deg^{-1} K	jg^{-1}	jg^{-1} deg^{-1} K	jg^{-1}	jg^{-1} deg^{-1} K	jg^{-1}
1	0.000035	0.0000175	0.000048	0.000024	0.000000263	0.0000000658	0.0000072	0.0000032
2	0.000074	0.000071	0.000097	0.000096	0.00000210	0.00000105	0.0000239	0.0000176
3	0.000122	0.000168	0.000147	0.000218	0.00000709	0.00000532	0.0000595	0.0000574
4	0.000186	0.000320	0.000201	0.000392	0.0000168	0.0000168	0.000124	0.000146
6	0.00037	0.00085	0.00032	0.00091	0.0000596	0.0000853	0.00039	0.00062
8	0.00067	0.00188	0.00047	0.00170	0.000140	0.000279	0.00091	0.00187
10	0.00112	0.00365	0.00065	0.00281	0.000275	0.000679	0.0018	0.00452
15	0.0033	0.0135	0.00135	0.00765	0.00109	0.00374	0.0064	0.0233
20	0.0074	0.0395	0.00271	0.0174	0.00337	0.0138	0.0155	0.076
25	0.0137	0.092	0.00561	0.0373	0.00849	0.0423	0.0287	0.185
30	0.0212	0.182	0.0106	0.0071	0.0171	0.105	0.0442	0.368
40	0.038	0.048	0.266	0.256	0.0440	0.400	0.078	0.979
50	0.055	0.95	0.0489	0.633	0.0785	1.00	0.108	1.91
60	0.068	1.56	0.9724	1.238	0.115	1.97	0.133	3.12
70	0.079	2.29	0.094	2.07	0.152	3.31	0.151	4.54
80	0.088	3.12	0.114	3.11	0.188	5.01	0.166	6.13
90	0.094	4.02	0.132	4.34	0.224	7.06	0.177	7.85
100	0.100	5.01	0.147	5.74	0.259	9.47	0.187	9.67

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