MELTING, BOILING, TRIPLE, AND CRITICAL POINT TEMPERATURES OF THE ELEMENTS

This table summarizes the significant points on the phase diagrams for the elements for which data are available. Values are given for the solid-liquid-gas triple point t_{tp}, normal melting point t_m, normal boiling point t_b, and critical temperature t_c; all are on the ITS-90 scale. An "sp" notation indicates a sublimation point, where the vapor pressure of the solid phase reaches 101.325 kPa (1 atm). Transition temperatures between allotropic forms are included for several elements. The major data sources are listed below; values from Reference 1, which deals with reference points on the ITS-90 scale, were adopted when applicable.

References

1. Bedford, R. E., Bonnier, G., Maas, H., and Pavese, F., *Metrologia* 33, 133, 1996.
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3. Chase, M.W., Davies, C.A., Downey, J.R., Frurip, D.J., McDonald, R.A., and Syverud, A.N., *JANAF Thermochemical Tables, Third Edition, J. Phys. Chem. Ref. Data*, Vol. 14, Suppl. 1, 1985.
4. Gurvich, L.V., Veyts, I.V., and Alcock, C.B., *Thermodynamic Properties of Individual Substances, Fourth Edition,* Hemisphere Publishing Corp., New York, 1989.
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Element	t_{tp}/°C	t_m/°C	t_b/°C	t_c/°C
Actinium		1050	3198	
Aluminum		660.32	2519	
Americium		1176	2011	
Antimony		630.628	1587	
Argon	-189.36 (69 kPa)		-185.847	-122.28
Arsenic (gray)	817 (3.70 MPa)		616 sp	1400
Astatine		302		
Barium		727	1897	
Berkelium (β form)		986		
Beryllium		1287	2471	
Bismuth		271.406	1564	
Boron		2075	4000	
Bromine		-7.2	58.8	315
Cadmium		321.069	767	
Calcium		842	1484	
Californium		900		
Carbon (graphite)	4489 (10.3 MPa)		3825 sp	
Carbon (diamond)		4440 (12.4 GPa)		
Cerium		799	3443	
Cesium		28.5	671	1665
Chlorine		-101.5	-34.04	143.8
Chromium		1907	2671	
Cobalt		1495	2927	
Copper		1084.62	2562	
Curium		1345	˜3100	
Dysprosium		1412	2567	
Einsteinium		860		
Erbium		1529	2868	
Europium		822	1529	
Fermium		1527		
Fluorine	-219.67		-188.12	-129.02
Francium		27		
Gadolinium		1313	3273	
Gallium	29.7666		2204	
Germanium		938.25	2833	
Gold		1064.18	2856	
Hafnium		2233	4603	
Helium			-268.93	-267.96
Holmium		1472	2700	
Hydrogen	-259.198 (7.2 kPa)	-259.1	-252.762	-240.18
Indium	156.5936	156.60	2072	
Iodine		113.7	184.4	546
Iridium		2446	4428	
Iron		1538	2861	
Krypton	-157.38 (73.2 kPa)		-153.34	-63.74
Lanthanum		920	3464	
Lawrencium		1627		
Lead		327.462	1749	

Element	t_{tp}/°C	t_m/°C	t_b/°C	t_c/°C
Lithium		180.50	1342	2950
Lutetium		1663	3402	
Magnesium		650	1090	
Manganese		1246	2061	
Mendelevium		827		
Mercury	-38.837	-38.8290	356.62	1477
Molybdenum		2623	4639	
Neodymium		1016	3074	
Neon	-248.609 (43 kPa)		-246.053	-228.7
Neptunium		644		
Nickel		1455	2913	
Niobium		2477	4744	
Nitrogen	-209.999	-210.0	-195.798	-146.94
Nobelium		827		
Osmium		3033	5012	
Oxygen		-218.79	-182.953	-118.56
Palladium		1554.8	2963	
Phosphorus (white)		44.15	280.5	721
Phosphorus (red)	590		431 sp	721
Phosphorus (black)		610		
Platinum		1768.2	3825	
Plutonium		640	3228	
Polonium		254	962	
Potassium		63.5	759	1950
Praseodymium		931	3520	
Promethium		1042	3000	
Protactinium		1572		
Radium		696		
Radon		-71	-61.7	104
Rhenium		3185	5596	
Rhodium		1964	3695	
Rubidium	39.26	39.30	688	1820
Ruthenium		2034	4150	
Samarium		1072	1794	
Scandium		1541	2836	
Selenium (vitreous)		180 (trans to gray)	685	1493
Selenium (gray)		220.8	685	1493
Silicon		1414	3265	
Silver		961.78	2162	
Sodium		97.794	882.940	2300
Strontium		777	1382	
Sulfur (rhombic)		95.3 (trans to monocl)	444.61	1041
Sulfur (monoclinic)		115.21	444.61	1041
Tantalum		3017	5458	
Technetium		2157	4265	
Tellurium		449.51	988	
Terbium		1359	3230	
Thallium		304	1473	
Thorium		1750	4788	
Thulium		1545	1950	
Tin (gray)		13.2 (trans to white)	2602	
Tin (white)		231.93	2602	
Titanium		1668	3287	
Tungsten		3422	5555	
Uranium		1135	4131	
Vanadium		1910	3407	
Xenon	-111.745 (81.6 kPa)		-108.09	16.62
Ytterbium		824	1196	
Yttrium		1522	3345	
Zinc		419.53	907	
Zirconium		1854.7	4409	