

TABLE A-25 Thermochemical Properties of Selected Substances at 298K and 1 atm

Substance	Formula	Molar Mass, <i>M</i> (kg/kmol)	Enthalpy of Formation, $\bar{h}_f^\circ$ (kJ/kmol)	Gibbs Function of Formation, $\bar{g}_f^\circ$ (kJ/kmol)	Absolute Entropy, $\bar{s}^\circ$ (kJ/kmol · K)	Heating Values	
						Higher, HHV (kJ/kg)	Lower, LHV (kJ/kg)
Carbon	C(s)	12.01	0	0	5.74	32,770	32,770
Hydrogen	H <sub>2</sub> (g)	2.016	0	0	130.57	141,780	119,950
Nitrogen	N <sub>2</sub> (g)	28.01	0	0	191.50	—	—
Oxygen	O <sub>2</sub> (g)	32.00	0	0	205.03	—	—
Carbon monoxide	CO(g)	28.01	−110,530	−137,150	197.54	—	—
Carbon dioxide	CO <sub>2</sub> (g)	44.01	−393,520	−394,380	213.69	—	—
Water	H <sub>2</sub> O(g)	18.02	−241,820	−228,590	188.72	—	—
Water	H <sub>2</sub> O(l)	18.02	−285,830	−237,180	69.95	—	—
Hydrogen peroxide	H <sub>2</sub> O <sub>2</sub> (g)	34.02	−136,310	−105,600	232.63	—	—
Ammonia	NH <sub>3</sub> (g)	17.03	−46,190	−16,590	192.33	—	—
Oxygen	O(g)	16.00	249,170	231,770	160.95	—	—
Hydrogen	H(g)	1.008	218,000	203,290	114.61	—	—
Nitrogen	N(g)	14.01	472,680	455,510	153.19	—	—
Hydroxyl	OH(g)	17.01	39,460	34,280	183.75	—	—
Methane	CH <sub>4</sub> (g)	16.04	−74,850	−50,790	186.16	55,510	50,020
Acetylene	C <sub>2</sub> H <sub>2</sub> (g)	26.04	226,730	209,170	200.85	49,910	48,220
Ethylene	C <sub>2</sub> H <sub>4</sub> (g)	28.05	52,280	68,120	219.83	50,300	47,160
Ethane	C <sub>2</sub> H <sub>6</sub> (g)	30.07	−84,680	−32,890	229.49	51,870	47,480
Propylene	C <sub>3</sub> H <sub>6</sub> (g)	42.08	20,410	62,720	266.94	48,920	45,780
Propane	C <sub>3</sub> H <sub>8</sub> (g)	44.09	−103,850	−23,490	269.91	50,350	46,360
Butane	C <sub>4</sub> H <sub>10</sub> (g)	58.12	−126,150	−15,710	310.03	49,500	45,720
Pentane	C <sub>5</sub> H <sub>12</sub> (g)	72.15	−146,440	−8,200	348.40	49,010	45,350
Octane	C <sub>8</sub> H <sub>18</sub> (g)	114.22	−208,450	17,320	463.67	48,260	44,790
Octane	C <sub>8</sub> H <sub>18</sub> (l)	114.22	−249,910	6,610	360.79	47,900	44,430
Benzene	C <sub>6</sub> H <sub>6</sub> (g)	78.11	82,930	129,660	269.20	42,270	40,580
Methyl alcohol	CH <sub>3</sub> OH(g)	32.04	−200,890	−162,140	239.70	23,850	21,110
Methyl alcohol	CH <sub>3</sub> OH(l)	32.04	−238,810	−166,290	126.80	22,670	19,920
Ethyl alcohol	C <sub>2</sub> H <sub>5</sub> OH(g)	46.07	−235,310	−168,570	282.59	30,590	27,720
Ethyl alcohol	C <sub>2</sub> H <sub>5</sub> OH(l)	46.07	−277,690	174,890	160.70	29,670	26,800

Source: Based on JANAF Thermochemical Tables, NSRDS-NBS-37, 1971; *Selected Values of Chemical Thermodynamic Properties*, NBS Tech. Note 270-3, 1968; and *API Research Project 44*, Carnegie Press, 1953. Heating values calculated.

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