

Standard Enthalpies of Combustion

Reference conditions: 25° C (298.16° K), 1 atm pressure, gaseous substances in ideal state

ΔH_c^0 = standard enthalpy of combustion, kcal per g-mole

Multiply values by 1000 to obtain g-cal per g-mole, or kcal per kg-mole.

Multiply values by 1800 to obtain Btu per lb-mole.

Abbreviations

s = solid

l = liquid

g = gaseous

Hydrocarbons

Final Products: CO₂(*g*), H₂O(*l*)

Compound	Formula	State	$-\Delta H_c^0$
Carbon (graphite)	C	<i>s</i>	94.0518
Carbon monoxide	CO	<i>g</i>	67.6361
Hydrogen	H ₂	<i>g</i>	68.3174
Methane	CH ₄	<i>g</i>	212.798
Ethyne (acetylene)	C ₂ H ₂	<i>g</i>	310.615
Ethene (ethylene)	C ₂ H ₄	<i>g</i>	337.234
Ethane	C ₂ H ₆	<i>g</i>	372.820
Propyne (allylene, methylacetylene)	C ₃ H ₄	<i>g</i>	463.109
Propene (propylene)	C ₃ H ₆	<i>g</i>	491.987
Propane	C ₃ H ₈	<i>g</i>	530.605
1,2-Butadiene	C ₄ H ₆	<i>g</i>	620.71
2-Methylpropene (isobutylene, isobutene)	C ₄ H ₈	<i>g</i>	646.134
2-Methylpropane (isobutane)	C ₄ H ₁₀	<i>g</i>	686.342
<i>n</i> -Butane	C ₄ H ₁₀	<i>g</i>	687.982
1-Pentene (amylene)	C ₅ H ₁₀	<i>g</i>	806.85
Cyclopentane	C ₅ H ₁₀	<i>l</i>	786.54
2,2-Dimethylpropane (neopentane)	C ₅ H ₁₂	<i>g</i>	840.49
2-Methylbutane (isopentane)	C ₅ H ₁₂	<i>g</i>	843.24
<i>n</i> -Pentane	C ₅ H ₁₂	<i>g</i>	845.16
Benzene	C ₆ H ₆	<i>g</i>	789.08
Benzene	C ₆ H ₆	<i>l</i>	780.98
1-Hexene (hexylene)	C ₆ H ₁₂	<i>g</i>	964.26
Cyclohexane	C ₆ H ₁₂	<i>l</i>	936.88
<i>n</i> -Hexane	C ₆ H ₁₄	<i>l</i>	995.01
Methylbenzene (toluene)	C ₇ H ₈	<i>g</i>	943.58
Methylbenzene (toluene)	C ₇ H ₈	<i>l</i>	934.50
Cycloheptane	C ₇ H ₁₄	<i>l</i>	1086.9
<i>n</i> -Heptane	C ₇ H ₁₆	<i>l</i>	1151.27
1,2-Dimethylbenzene (<i>o</i> -xylene)	C ₈ H ₁₀	<i>g</i>	1098.54
1,2-Dimethylbenzene (<i>o</i> -xylene)	C ₈ H ₁₀	<i>l</i>	1088.16
1,3-Dimethylbenzene (<i>m</i> -xylene)	C ₈ H ₁₀	<i>g</i>	1098.12
1,3-Dimethylbenzene (<i>m</i> -xylene)	C ₈ H ₁₀	<i>l</i>	1087.92
1,4-Dimethylbenzene (<i>p</i> -xylene)	C ₈ H ₁₀	<i>g</i>	1098.29
1,4-Dimethylbenzene (<i>p</i> -xylene)	C ₈ H ₁₀	<i>l</i>	1088.16
<i>n</i> -Octane	C ₈ H ₁₈	<i>l</i>	1307.53
1,3,5-Trimethylbenzene (mesitylene)	C ₉ H ₁₂	<i>l</i>	1241.19
Naphthalene	C ₁₀ H ₈	<i>s</i>	1231.6
<i>n</i> -Decane	C ₁₀ H ₂₂	<i>l</i>	1620.06
Diphenyl	C ₁₂ H ₁₀	<i>s</i>	1493.5
Anthracene	C ₁₄ H ₁₀	<i>s</i>	1695
Phenanthrene	C ₁₄ H ₁₀	<i>s</i>	1693
<i>n</i> -Hexadecane	C ₁₆ H ₃₄	<i>l</i>	2557.64

Alcohols

Final Products: $\text{CO}_2(g)$, $\text{H}_2\text{O}(l)$

Compound	Formula	State	$-\Delta H_c^\circ$
Methyl alcohol	CH_4O	<i>g</i>	182.59
Methyl alcohol	CH_4O	<i>l</i>	173.65
Ethyl alcohol	$\text{C}_2\text{H}_6\text{O}$	<i>g</i>	336.82
Ethyl alcohol	$\text{C}_2\text{H}_6\text{O}$	<i>l</i>	326.70
Ethylene glycol	$\text{C}_2\text{H}_6\text{O}_2$	<i>l</i>	284.48
Allyl alcohol	$\text{C}_3\text{H}_6\text{O}$	<i>l</i>	442.3
<i>n</i> -Propyl alcohol	$\text{C}_3\text{H}_8\text{O}$	<i>g</i>	494.26
<i>n</i> -Propyl alcohol	$\text{C}_3\text{H}_8\text{O}$	<i>l</i>	483.56
Isopropyl alcohol	$\text{C}_3\text{H}_8\text{O}$	<i>g</i>	493.02
Isopropyl alcohol	$\text{C}_3\text{H}_8\text{O}$	<i>l</i>	481.11
Glycerol	$\text{C}_3\text{H}_8\text{O}_3$	<i>l</i>	396.27
<i>n</i> -Butyl alcohol	$\text{C}_4\text{H}_{10}\text{O}$	<i>g</i>	649.98
<i>n</i> -Butyl alcohol	$\text{C}_4\text{H}_{10}\text{O}$	<i>l</i>	638.18
Amyl alcohol	$\text{C}_5\text{H}_{12}\text{O}$	<i>l</i>	786.7
Methyl-diethyl carbinol	$\text{C}_6\text{H}_{14}\text{O}$	<i>l</i>	926.9

Acids

Final Products: $\text{CO}_2(g)$, $\text{H}_2\text{O}(l)$

Formic (monomolecular)	CH_2O_2	<i>g</i>	75.70
Formic	CH_2O_2	<i>l</i>	64.57
Oxalic	$\text{C}_2\text{H}_2\text{O}_4$	<i>s</i>	58.82
Acetic	$\text{C}_2\text{H}_4\text{O}_2$	<i>g</i>	219.82
Acetic	$\text{C}_2\text{H}_4\text{O}_2$	<i>l</i>	208.34
Acetic anhydride	$\text{C}_4\text{H}_6\text{O}_3$	<i>g</i>	432.34
Acetic anhydride	$\text{C}_4\text{H}_6\text{O}_3$	<i>l</i>	426.00
Glycolic	$\text{C}_2\text{H}_4\text{O}_3$	<i>s</i>	166.54
Propionic	$\text{C}_3\text{H}_6\text{O}_2$	<i>g</i>	378.36
Propionic	$\text{C}_3\text{H}_6\text{O}_2$	<i>l</i>	365.41
Lactic	$\text{C}_3\text{H}_6\text{O}_3$	<i>s</i>	325.8
<i>d</i> -Tartaric	$\text{C}_4\text{H}_6\text{O}_6$	<i>s</i>	274.9
<i>n</i> -Butyric	$\text{C}_4\text{H}_8\text{O}_2$	<i>l</i>	520
Citric (anhydrous)	$\text{C}_6\text{H}_8\text{O}_7$	<i>s</i>	474.3
Benzoic	$\text{C}_7\text{H}_6\text{O}_2$	<i>s</i>	771.5
<i>o</i> -Phthalic	$\text{C}_8\text{H}_6\text{O}_4$	<i>s</i>	770.8
Phthalic anhydride	$\text{C}_8\text{H}_4\text{O}_3$	<i>s</i>	781.4
<i>o</i> -Toluic	$\text{C}_8\text{H}_8\text{O}_2$	<i>s</i>	928.6
Palmitic	$\text{C}_{16}\text{H}_{32}\text{O}_2$	<i>s</i>	2379
Stearic	$\text{C}_{18}\text{H}_{32}\text{O}_2$	<i>s</i>	2628
Elaidic	$\text{C}_{18}\text{H}_{34}\text{O}_2$	<i>s</i>	2663
Oleic	$\text{C}_{18}\text{H}_{34}\text{O}_2$	<i>l</i>	2668
Stearic	$\text{C}_{18}\text{H}_{36}\text{O}_2$	<i>s</i>	2697

Carbohydrates, Cellulose, Starch, etc.

Final Products: $\text{CO}_2(g)$, $\text{H}_2\text{O}(l)$

<i>d</i> -Glucose (dextrose)	$\text{C}_6\text{H}_{12}\text{O}_6$	<i>s</i>	673
<i>l</i> -Fructose	$\text{C}_6\text{H}_{12}\text{O}_6$	<i>s</i>	675
Lactose (anhydrous)	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	<i>s</i>	1350.1
Sucrose	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$	<i>s</i>	1348.9
			g-cal
Starch			per gram
Dextrin			4177
Cellulose			4108
Cellulose acetate			4179
			4495

Other CHO Compounds

Final Products: $\text{CO}_2(g)$, $\text{H}_2\text{O}(l)$

Compound	Formula	State	$-\Delta H_c^\circ$
Formaldehyde	CH_2O	<i>g</i>	134.67
Acetaldehyde	$\text{C}_2\text{H}_4\text{O}$	<i>g</i>	284.98
Acetone	$\text{C}_3\text{H}_6\text{O}$	<i>g</i>	435.32
Acetone	$\text{C}_3\text{H}_6\text{O}$	<i>l</i>	427.79
Methyl acetate	$\text{C}_3\text{H}_6\text{O}_2$	<i>g</i>	397.5
Ethyl acetate	$\text{C}_4\text{H}_8\text{O}_2$	<i>g</i>	547.46
Ethyl acetate	$\text{C}_4\text{H}_8\text{O}_2$	<i>l</i>	538.76
Diethyl ether	$\text{C}_4\text{H}_{10}\text{O}$	<i>l</i>	652.59
Diethyl ketone	$\text{C}_5\text{H}_{10}\text{O}$	<i>l</i>	738.05
Phenol	$\text{C}_6\text{H}_6\text{O}$	<i>g</i>	747.55
Phenol	$\text{C}_6\text{H}_6\text{O}$	<i>l</i>	731.46
Pyrogallol	$\text{C}_6\text{H}_6\text{O}_3$	<i>s</i>	639
Amyl acetate	$\text{C}_7\text{H}_{14}\text{O}_2$	<i>l</i>	1040
Camphor	$\text{C}_{10}\text{H}_{16}\text{O}$	<i>s</i>	1411

Nitrogen Compounds

Final Products: $\text{CO}_2(g)$, $\text{N}_2(g)$, $\text{H}_2\text{O}(l)$

Urea	$\text{CH}_4\text{N}_2\text{O}$	<i>s</i>	151.05
Cyanogen	C_2N_2	<i>g</i>	261.70
Trimethylamine	$\text{C}_3\text{H}_9\text{N}$	<i>l</i>	578.4
Pyridine	$\text{C}_5\text{H}_5\text{N}$	<i>l</i>	660
Trinitrobenzene (1,3,5)	$\text{C}_6\text{H}_3\text{N}_3\text{O}_6$	<i>s</i>	664.0
Trinitrophenol (2,4,6)	$\text{C}_6\text{H}_3\text{N}_3\text{O}_7$	<i>s</i>	620.0
<i>o</i> -Dinitrobenzene	$\text{C}_6\text{H}_4\text{N}_2\text{O}_4$	<i>s</i>	703.2
Nitrobenzene	$\text{C}_6\text{H}_5\text{NO}_2$	<i>l</i>	739
<i>o</i> -Nitrophenol	$\text{C}_6\text{H}_5\text{NO}_2$	<i>s</i>	689
<i>o</i> -Nitroaniline	$\text{C}_6\text{H}_5\text{N}_2\text{O}_2$	<i>s</i>	766
Aniline	$\text{C}_6\text{H}_7\text{N}$	<i>l</i>	812
Trinitrotoluene (2,4,6)	$\text{C}_7\text{H}_5\text{N}_3\text{O}_6$	<i>s</i>	821
Nicotine	$\text{C}_{10}\text{H}_{14}\text{N}_2$	<i>l</i>	1428

Halogen Compounds

Final Products: $\text{CO}_2(g)$, $\text{H}_2\text{O}(l)$, dil.sol. of HCl

Carbon tetrachloride	CCl_4	<i>g</i>	92.01
Carbon tetrachloride	CCl_4	<i>l</i>	84.17
Chloroform	CHCl_3	<i>g</i>	121.8
Chloroform	CHCl_3	<i>l</i>	114.3
Methyl chloride	CH_3Cl	<i>g</i>	182.81
Chloroacetic acid	$\text{C}_2\text{H}_3\text{ClO}_2$	<i>s</i>	172.24
Ethylene dichloride	$\text{C}_2\text{H}_4\text{Cl}_2$	<i>l</i>	296.77
Ethyl chloride	$\text{C}_2\text{H}_5\text{Cl}$	<i>g</i>	339.66

Sulfur Compounds

Final Products: $\text{CO}_2(g)$, $\text{SO}_2(g)$, $\text{H}_2\text{O}(l)$

Carbonyl sulfide	COS	<i>g</i>	132.21
Carbon disulfide	CS_2	<i>g</i>	263.52
Carbon disulfide	CS_2	<i>l</i>	256.97
Methyl mercaptan	CH_4S	<i>g</i>	298.68
Dimethyl sulfide	$\text{C}_2\text{H}_6\text{S}$	<i>g</i>	457.12
Dimethyl sulfide	$\text{C}_2\text{H}_6\text{S}$	<i>l</i>	450.42
Ethyl mercaptan	$\text{C}_2\text{H}_6\text{S}$	<i>l</i>	448.0