BOND DISSOCIATION ENERGIES

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The bond dissociation energy (enthalpy) is also referred to as bond disruption energy, bond energy, bond strength, or binding energy (abbreviation: BDE, BE, or D). It is defined as the standard enthalpy change of the following fission: R–X → R + X. The BDE, denoted by D^o(R–X), is usually derived by the thermochemical equation, D^o(R–X) = $\Delta_f H^o$(R) + $\Delta_f H^o$(X) – $\Delta_f H^o$(RX). The enthalpy of formation $\Delta_f H^o$ of a large number of atoms, free radicals, ions, clusters and compounds is available from the website of NIST, NASA, CODATA, and IUPAC. Most authors prefer to use the BDE values at 298.15 K.

The following seven tables provide essential information of experimental BDE values of R–X and R^+–X bonds.

(1) Table 1: Bond Dissociation Energies in Diatomic Molecules
(2) Table 2: Enthalpy of Formation of Gaseous Atoms
(3) Table 3: Bond Dissociation Energies in Polyatomic Molecules
(4) Table 4: Enthalpies of Formation of Free Radicals and Other Transient Species
(5) Table 5: Bond Dissociation Energies of Common Organic Molecules
(6) Table 6: Bond Dissociation Energies in Diatomic Cations
(7) Table 7: Bond Dissociation Energies in Polyatomic Cations

The data in these tables have been revised through September 2005.

TABLE 1. Bond Dissociation Energies in Diatomic Molecules

The BDEs in diatomic species have usually been measured by spectroscopy or mass spectrometry. In the absence of data on enthalpy function, the values at 0 K, D^o(A–B), are converted to D^o_{298} by the approximate equation:

$$D^o_{298}(\text{A–B}) \approx D^o(\text{A–B}) + (3/2)RT = D^o(\text{A–B}) + 3.7181 \text{ kJ mol}^{-1}$$

This table has been arranged in alphabetical order of the atoms A in the diatomics A–B and all data are taken from the *Comprehensive Handbook of Chemical Bond Energies*, by Yu-Ran Luo, Taylor & Francis, 2006, which contains detailed references.

A-B	D^o_{298}/kJ mol^{-1}	A-B	D^o_{298}/kJ mol^{-1}	A-B	D^o_{298}/kJ mol^{-1}	A-B	D^o_{298}/kJ mol^{-1}
Ac–O	794	Al–Al	133±5.8	Al–Ti	263.4	As–Cl	448
Ag–Ag	162.9±2.9	Al–Ar	5.69	Al–U	326±29	As–D	270.3
Ag–Al	183.7±9.2	Al–As	202.7±7.1	Al–V	147.4±1.0	As–F	410
Ag–Au	202.5±9.6	Al–Au	325.9±6.3	Al–Xe	7.39	As–Ga	202.5±4.8
Ag–Bi	192±42	Al–Br	429.2±5.8	Am–O	553±36	As–H	274.0±2.9
Ag–Br	281.5±1.3	Al–C	267.7	Ar–Ar	4.91	As–I	296.6±24
Ag–Cl	279.1±8.4	Al–Ca	52.7	Ar–B	4.62	As–In	201±10
Ag–Cu	171.5±9.6	Al–Cl	502	Ar–Br	~5.0	As–N	489±2.1
Ag–D	226.8	Al–Co	181.6±0.2	Ar–C	5.158	As–O	484±8
Ag–Dy	130±19	Al–Cr	222.9±0.9	Ar–Ca	4.44±0.60	As–P	433.5±12.6
Ag–Eu	127±13	Al–Cu	227.1±1.2	Ar–Cd	5.57±0.05	As–S	379.5±6.3
Ag–F	356.9±5.8	Al–D	290.4	Ar–Ga	3.96	As–Sb	330.5±5.4
Ag–Ga	159±17	Al–F	675	Ar–Ge	<5.4	As–Se	96
Ag–Ge	174.5±21	Al–H	288±13	Ar–He	3.96	As–Tl	198.3±14.6
Ag–H	202.4±9.6	Al–I	369.9±2.1	Ar–Hg	5.32	Au–Au	226.2±0.5
Ag–Ho	124±19	Al–Kr	6.05	Ar–I	~5.3	Au–B	367.8±10.5
Ag–I	234±29	Al–Li	76.1	Ar–In	4.18	Au–Ba	254.8±10.0
Ag–In	166.5±4.9	Al–N	≤368±15	Ar–Kr	5.11	Au–Be	237.7±4.0
Ag–Li	186.1	Al–Ne	3.9	Ar–Li	~7.82	Au–Bi	293±8.4
Ag–Mn	99.2±21	Al–Ni	224.7±4.8	Ar–Mg	~3.7	Au–Br	213±21
Ag–Na	133.1±12.6	Al–O	501.9±10.6	Ar–Na	~4.2	Au–Ca	250.4±4.0
Ag–Nd	<213	Al–P	216.7±12.6	Ar–Ne	4.27	Au–Ce	322±18
Ag–O	221±21	Al–Pd	254.4±12.1	Ar–Si	5.86	Au–Cl	280±13
Ag–S	216.7±14.6	Al–S	332±10	Ar–Sn	<5.1	Au–Co	218.0±16.4
Ag–Se	210.0±14.6	Al–Sb	216.3±6	Ar–Tl	4.09	Au–Cr	223.7±28.9
Ag–Si	185.1±9.6	Al–Se	318±13	Ar–Xe	5.28	Au–Cs	253±3.5
Ag–Sn	136±21	Al–Si	246.9±12.6	Ar–Zn	5.0	Au–Cu	227.1±1.2
Ag–Te	195.8±14.6	Al–Te	268±13	As–As	385.8±10.5	Au–D	322.2

A-B	D^o_{298}/kJ mol^{-1}
Au–Dy	259±24
Au–Eu	245±12
Au–F	294.1
Au–Fe	187.0±19.3
Au–Ga	290±15
Au–Ge	273.2±14.6
Au–H	328
Au–Ho	267±35
Au–I	276
Au–In	286.0±5.7
Au–La	457±28
Au–Li	284.5±6.7
Au–Lu	332±19
Au–Mg	179.1±2.7
Au–Mn	197.7±21
Au–Na	215.1±12.6
Au–Nd	294±29
Au–Ni	247±16.4
Au–O	223±21
Au–Pb	133±42
Au–Pd	142.7±21
Au–Pr	311±25
Au–Rb	243±3.5
Au–Rh	232.6±29
Au–S	253.6±14.6
Au–Sc	280±40
Au–Se	251.0±14.6
Au–Si	304.6±6.0
Au–Sn	256.5±7.2
Au–Sr	264±42
Au–Tb	285±33
Au–Te	237.2±14.6
Au–U	318±29
Au–V	246.0±8.7
Au–Y	310±12
B–B	290
B–Br	390.9±0.5
B–C	448±29
B–Cd	301.0
B–Ce	305±21
B–Cl	427
B–D	341.0±6.3
B–F	732
B–H	345.2±2.5
B–I	361
B–Ir	512.2±17
B–La	335±63
B–N	377.9±8.7
B–Ne	3.97
B–O	809
B–P	347±16.7
B–Pd	351.5±16.7
B–Pt	477.8±16.7
B–Rh	475.8±21
B–Ru	446.9±21
B–S	577±9.2
B–Sc	272±63
B–Se	462±14.6
B–Si	317±12
B–Te	354±20
B–Th	297±33
B–Ti	272±63
B–U	322±33
B–Y	289±63
Ba–Br	402
Ba–Cl	443
Ba–D	≤193.7
Ba–F	580.6
Ba–H	192.0
Ba–I	322.6±6.3
Ba–O	562±13.4
Ba–Pd	221.8±5.0
Ba–Rh	259.4±25
Ba–S	418±21
Be–Be	59
Be–Br	316
Be–Cl	434
Be–D	203.1
Be–F	573
Be–H	221
Be–I	261
Be–O	437
Be–S	372±59
Be–T	204.4
Bi–Bi	204.4
Bi–Br	240.2
Bi–Cl	300.4±4.2
Bi–D	283.7
Bi–F	366.5±12.5
Bi–Ga	158.6±16.7
Bi–H	≤283.3
Bi–I	186.1±5.8
Bi–In	153.6±1.7
Bi–Li	149.4
Bi–O	337.2±12.6
Bi–P	281.7±13
Bi–Pb	142.4±3.0
Bi–S	315.5±4.6
Bi–Sb	252.7±3.9
Bi–Se	280.3±5.9
Bi–Sn	193±13
Bi–Te	232.2±11.3
Bi–Tl	120.9±12.6
Bk–O	598
Br–Br	193.859±0.120
Br–C	318.0±8.4
Br–Ca	339
Br–Cd	159±96
Br–Ce	373.2
Br–Cl	219.32±0.05
Br–Co	326±42
Br–Cr	328.0±24.3
Br–Cs	389.1±4.2
Br–Cu	331±25
Br–D	370.74
Br–Dy	339.3±10.5
Br–Er	361.3
Br–Eu	548
Br–F	280±12
Br–Fe	243±84
Br–Ga	402±13
Br–Gd	372.0
Br–Ge	347±8
Br–H	366.16±0.20
Br–Hg	74.9
Br–Ho	321.8
Br–I	179.1±0.4
Br–In	409±10
Br–K	379.1±4.2
Br–La	446.2
Br–Li	418.8±4.2
Br–Lu	301.5
Br–Mg	317.96
Br–Mn	314.2±9.6
Br–Mo	313.4
Br–N	280.8±21
Br–Na	363.1±4.2
Br–Nd	339.7
Br–Ni	360±13
Br–O	235.4±1.9
Br–P	≤329
Br–Pb	248.5±14.6
Br–Pr	344.5
Br–Rb	380.7±4.2
Br–S	218±17
Br–Sb	314±59
Br–Sc	444±63
Br–Se	297±84
Br–Si	358.2±8.4
Br–Sm	331.4
Br–Sn	337±13
Br–Sr	365
Br–T	372.77
Br–Tb	382.8
Br–Th	364
Br–Ti	373
Br–Tl	331±21
Br–Tm	299.1
Br–U	377±15
Br–V	439±42
Br–W	329.3
Br–Xe	5.94±0.02
Br–Y	481±84
Br–Yb	295.4
Br–Zn	138±29
Br–Zr	420
C–C	618.3±15.4
C–Ce	443±30
C–Cl	394.9±13.4
C–D	341.4
C–F	513.8±10.0
C–Fe	376.3±28.9
C–Ge	455.7±11
C–H	338.4±1.2
C–Hf	540±25
C–I	253.1±35.6
C–Ir	631±5
C–La	463±20
C–Mo	482±16
C–N	750.0±2.9
C–Nb	523.8±14.5
C–Ni	337.0
C–O	1076.38±0.67
C–Os	608±25
C–P	507.5±8.8
C–Pd	436±20
C–Pt	610±5
C–Rh	580±4
C–Ru	648±13
C–S	713.3±1.2
C–Sc	444±21
C–Se	590.4±5.9
C–Si	447
C–Tc	564±29
C–Th	453±17
C–Ti	423±30
C–U	455±15
C–V	423±24
C–Y	418±14
C–Zr	495.8±38.6
Ca–Ca	16.52±0.11
Ca–Cl	409±8.7
Ca–D	≤169.9
Ca–F	529
Ca–H	223.8
Ca–I	284.7±8.4
Ca–Kr	5.15±0.72
Ca–Li	84.9±8.4

A-B	D^o_{298}/kJ mol^{-1}
Ca–O	383.3±5.0
Ca–Pd	347 - 360
Ca–S	335±21
Ca–Xe	7.31±0.96
Cd–Cd	~8.62
Cd–Cl	208.4
Cd–F	305±21
Cd–H	69.0±0.4
Cd–I	97.2±2.1
Cd–In	134
Cd–K	7.3
Cd–Kr	5.17
Cd–Na	10.2
Cd–Ne	3.97
Cd–O	236±84
Cd–S	208.5±20.9
Cd–Se	127.6±25.1
Cd–Te	100.0±15.1
Cd–Xe	6.54
Ce–Ce	251.7
Ce–Cl	457.0
Ce–F	582±42
Ce–I	333.8
Ce–Ir	575±9
Ce–N	519±21
Ce–O	790
Ce–Os	524±20
Ce–Pd	319±21
Ce–Pt	550±5
Ce–Rh	545±7
Ce–Ru	494±12
Ce–S	569
Ce–Se	494.5±14.6
Ce–Te	189.4±12.6
Cf–O	498
Cl–Cl	242.417±1.930
Cl–Co	337.6±6.7
Cl–Cr	377.8±6.7
Cl–Cs	445.7±7.7
Cl–Cu	377.8±7.5
Cl–D	436.303±0.011
Cl–Dy	392.4
Cl–Er	448.6
Cl–Eu	405.5
Cl–F	260.83
Cl–Fe	329.7±6.7
Cl–Ga	463±13
Cl–Gd	451.0
Cl–Ge	390.8±9.6
Cl–H	431.361±0.013
Cl–Hg	92.0±9.2
Cl–Ho	409.1
Cl–I	211.3±0.4
Cl–In	436±8
Cl–K	433.0±8.4
Cl–La	521.6
Cl–Li	469±13
Cl–Lu	325.7±2
Cl–Mg	312
Cl–Mn	338.5±6.7
Cl–N	333.9±9.6
Cl–Na	412.1±8.4
Cl–Nd	418.7
Cl–Ni	377.0±6.7
Cl–O	267.47±0.08
Cl–P	≤376
Cl–Pb	301±50
Cl–Pr	423.5
Cl–Ra	343±75
Cl–Rb	427.6±8.4
Cl–S	241.8
Cl–Sb	360±50
Cl–Sc	331
Cl–Se	322
Cl–Si	416.7±6.3
Cl–Sm	418.7
Cl–Sn	350±8
Cl–Sr	409
Cl–T	438.64
Cl–Ta	544
Cl–Tb	470.1
Cl–Th	489
Cl–Ti	405.4±10.5
Cl–Tl	372.8±2.1
Cl–Tm	378.0
Cl–U	439
Cl–V	477±63
Cl–W	419
Cl–Xe	7.08
Cl–Y	523±84
Cl–Yb	374.5
Cl–Zn	229±8
Cl–Zr	530
Cm–O	732
Co–Co	<127
Co–Cu	161.1±16.4
Co–D	270.2±5.8
Co–F	431±63
Co–Ge	230±21
Co–H	244.9±4.8
Co–I	280±21
Co–Mn	50±8
Co–Nb	267.02±0.10
Co–O	384.5±13.4
Co–S	331
Co–Si	274.4±17
Co–Ti	235.37±0.10
Co–Y	253.71±0.10
Co–Zr	306.39±0.10
Cr–Cr	152.0±6
Cr–Cu	154.4±14.5
Cr–F	523±19
Cr–Fe	~75
Cr–Ge	154±7
Cr–H	189.9±6.7
Cr–I	287.0±24.3
Cr–N	377.8±18.8
Cr–Nb	295.72±0.06
Cr–O	461±8.7
Cr–Pb	105±2
Cr–S	331
Cr–Sn	141±3
Cs–Cs	43.919±0.010
Cs–F	517.1±7.7
Cs–H	175.364
Cs–Hg	8
Cs–I	338.5±2.1
Cs–Na	63.2±1.3
Cs–O	293±25
Cs–Rb	49.57±0.01
Cu–Cu	201
Cu–D	270.3
Cu–Dy	144±18
Cu–F	414
Cu–Ga	215.9±15
Cu–Ge	208.8±21
Cu–H	254.8±6
Cu–Ho	144±19
Cu–I	289±63
Cu–In	187.4±7.9
Cu–Li	191.9
Cu–Na	176.1±16.7
Cu–Ni	201.7±9.6
Cu–O	287.4±11.6
Cu–S	274.5±14.6
Cu–Se	255.2±14.6
Cu–Si	221.3±6.3
Cu–Sn	170±10
Cu–Tb	191±18
Cu–Te	230.5±14.6
D–D	443.3197±0.0003
D–F	576.174±0.096
D–Ga	<276.5
D–Ge	≤322
D–H	439.2223±0.0002
D–Hg	42.05
D–I	302.33
D–In	246
D–K	182.4
D–Li	240.24
D–Lu	302
D–Mg	161.33±0.32
D–Mn	312±6
D–N	341.6
D–Ni	≤302.9
D–O	429.64
D–P	299.0
D–Pt	≤350.2
D–S	350.62±1.20
D–Si	302.5
D–Sr	167.7
D–T	444.91
D–Tl	193.0
D–Zn	88.7
Dy–Dy	70.3
Dy–F	531
Dy–I	269.0±8.4
Dy–O	615
Dy–S	414±42
Dy–Se	322±20
Dy–Te	234±20
Er–Er	75±29
Er–F	565±17
Er–I	315.8
Er–O	606
Er–S	418±21
Er–Se	326±20
Er–Te	238±20
Es–O	460
Eu–Eu	45.2
Eu–F	544
Eu–I	288.3
Eu–Li	268.1±12.6
Eu–O	473
Eu–Rh	238±34
Eu–S	365.7±13.4
Eu–Se	302.9±14.6
Eu–Te	251.0±14.6
F–F	158.670±0.096
F–Fe	447
F–Ga	584±13
F–Gd	590±17
F–Ge	523±13
F–H	569.658±0.012
F–Hf	650±15
F–Hg	~180
F–Ho	540
F–I	≤271.5

A-B	D^o_{298}/kJ mol^{-1}
F–In	516±13
F–K	489.2
F–Kr	6.6
F–La	659.0±17.2
F–Li	577±21
F–Lu	405±19
F–Mg	463
F–Mn	445.2±7.5
F–Mo	464
F–N	≤349
F–Na	477.3
F–Nd	545.2±12.6
F–Ni	428.4±19.3
F–Np	430±50
F–O	220
F–P	≤405
F–Pb	355±13
F–Pr	582±46
F–Pu	538±29
F–Rb	494±21
F–Ru	402
F–S	343.5±6.7
F–Sb	439±96
F–Sc	599.1±13.4
F–Se	339±42
F–Si	576.4±17
F–Sm	565
F–Sn	476±8
F–Sr	538
F–T	579.009±0.108
F–Ta	573±13
F–Tb	561±42
F–Th	652
F–Ti	569±33
F–Tl	439±21
F–Tm	510
F–U	648
F–V	590±63
F–W	≤544
F–Xe	14.18
F–Y	685.3±13.4
F–Yb	≥517.6±9.6
F–Zn	364±63
F–Zr	627.2±10.5
Fe–Fe	118
Fe–Ge	210.9±29
Fe–H	148±3
Fe–I	123
Fe–O	407.0±1.0
Fe–S	328.9±14.6
Fe–Si	297±25
Fm–O	443

A-B	D^o_{298}/kJ mol^{-1}
Ga–Ga	<106.4
Ga–H	276
Ga–I	334±13
Ga–In	94.0±3
Ga–Kr	4.08
Ga–Li	133.1±14.6
Ga–O	374±21
Ga–P	229.7±12.6
Ga–Sb	192.0±12.6
Ga–Te	265±21
Ga–Xe	5.27
Gd–Gd	206.3±67.5
Gd–I	333.8
Gd–O	715
Gd–S	526.8±10.5
Gd–Se	430±15
Gd–Te	341±15
Ge–Ge	264.4±6.8
Ge–H	263.2±4.8
Ge–I	268±25
Ge–Ni	290.3±10.9
Ge–O	660.3
Ge–Pd	254.7±10.5
Ge–S	534±3
Ge–Sc	270±11
Ge–Se	484.7±1.7
Ge–Si	297
Ge–Sn	230.1±13
Ge–Te	396.7±3.3
Ge–Y	279±11
H–H	435.7799±0.0001
H–Hg	39.844
H–I	298.26±0.10
H–In	243.1
H–K	174.576
H–Li	238.039±0.006
H–Mg	126.4±2.9
H–Mn	251±5
H–Mo	211±19
H–N	≤338.9
H–Na	185.69±0.29
H–Nb	>221.9±9.6
H–Ni	240±8
H–O	429.91±0.29
H–P	297.0±2.1
H–Pb	≤157
H–Pd	234±25
H–Pt	330
H–Rb	172.6
H–Rh	241.0±5.9
H–Ru	223±15
H–S	353.57±0.30

A-B	D^o_{298}/kJ mol^{-1}
H–Sb	239.7±4.2
H–Sc	205±17
H–Se	312.5
H–Si	293.3±1.9
H–Sn	264±17
H–Sr	164±8
H–T	440.49
H–Te	270.7±1.7
H–Ti	204.6±8.8
H–Tl	195.4±4
H–V	209.3±6.8
H–Yb	183.1±2.0
H–Zn	85.8±2
He–He	3.809
He–Hg	3.8
He–Xe	3.8
Hf–Hf	328±58
Hf–N	535±30
Hf–O	801±13
Hg–Hg	7.79±0.24
Hg–I	34.69±0.96
Hg–K	8.8
Hg–Kr	5.75
Hg–Li	13.16±0.38
Hg–Na	10.8
Hg–Ne	4.14
Hg–O	269
Hg–Rb	8.4
Hg–S	217.3±22.2
Hg–Se	144.3±30.1
Hg–T	43.14
Hg–Te	<142
Hg–Tl	2.9
Hg–Xe	6.65
Ho–Ho	70.3
Ho–I	275.1
Ho–O	606
Ho–S	428.4±14.6
Ho–Se	333±15
Ho–Te	≤259±15
I–I	152.25±0.57
I–In	306.9±1.1
I–K	322.5±2.1
I–Kr	5.67
I–La	411.7
I–Li	345.2±4.2
I–Lu	263.2
I–Mg	229
I–Mn	282.8±9.6
I–Mo	266.9
I–N	159±17
I–Na	304.2±2.1

A-B	D^o_{298}/kJ mol^{-1}
I–Nd	301.5
I–Ni	293±21
I–O	240±5
I–Pb	194±38
I–Pr	306.2
I–Rb	318.8±2.1
I–Si	243.1±8.4
I–Sm	293.1
I–Sn	235±3
I–Sr	301
I–Tb	336.2
I–Te	192±42
I–Th	361±25
I–Ti	306
I–Tl	285±21
I–Tm	260.8
I–U	299±27
I–Xe	~6.9
I–Y	422.6±12.5
I–Yb	257.3
I–Zn	153.1±6.3
I–Zr	127
In–In	82.0±5.7
In–Kr	4.85
In–Li	92.5±14.6
In–O	346±30
In–P	197.9±8.4
In–S	287.9±14.6
In–Sb	151.9±10.5
In–Se	245.2±14.6
In–Te	215.5±14.6
In–Xe	6.48
In–Zn	32.2
Ir–Ir	361±68
Ir–La	577±12
Ir–Nb	465±25
Ir–O	414±42
Ir–Si	462.8±21
Ir–Th	574±42
Ir–Ti	422±13
Ir–Y	457±15
K–K	56.96
K–Kr	4.6
K–Li	82.0±4.2
K–Na	65.994±0.008
K–Zn	6.5
K–O	271.5±12.6
K–Rb	53.723±0.005
K–Xe	5.0
Kr–Kr	5.39
Kr–Li	~12.1
Kr–Mg	6.71±0.96

A-B	D^o_{298}/kJ mol^{-1}
Kr–Na	~4.53
Kr–Ne	4.31
Kr–O	<8
Kr–Tl	4.14
Kr–Xe	5.66
Kr–Zn	5.0
La–La	244.9
La–N	519±42
La–O	798
La–Pt	505±12
La–Rh	550±12
La–S	573.4±1.7
La–Se	485.7±14.6
La–Te	385.6±15
La–Y	197±21
Li–Li	105.0
Li–Mg	67.4±6.3
Li–Na	87.181±0.001
Li–O	340.5±6.3
Li–Pb	78.7±8
Li–S	312.5±7.5
Li–Sb	169.0±10.0
Li–Si	149
Li–Sm	193.3±18.8
Li–Tm	276.1±14.6
Li–Xe	~12.1
Li–Yb	143.5±12.6
Lr–O	665
Lu–Lu	142±33
Lu–O	669
Lu–Pt	402±34
Lu–S	508.4±14.4
Lu–Se	418±15
Lu–Te	325±15
Md–O	418
Mg–Mg	11.3
Mg–Ne	~4.1
Mg–O	358.2±7.2
Mg–S	234
Mg–Xe	9.70±1.79
Mn–Mn	61.6±9.6
Mn–O	362±25
Mn–S	301±17
Mn–Se	239.3±9.2
Mo–Mo	435.5±1.0
Mo–Nb	452±25
Mo–O	502
N–N	944.84±0.10
N–O	631.62±0.18
N–P	617.1±20.9
N–Pt	374.2±9.6
N–Pu	469±63
N–S	467±24
N–Sb	460±84
N–Sc	464±84
N–Si	437.1±9.9
N–Ta	607±84
N–Th	577±33
N–Ti	476±33
N–U	531±21
N–V	523±38
N–Xe	26.9
N–Y	477±63
N–Zr	565±25
Na–Na	74.805±0.586
Na–Ne	~3.8
Na–O	270±4
Na–Rb	63.887±0.024
Na–Xe	~5.12
Nb–Nb	513
Nb–Ni	271.9±0.1
Nb–O	726.5±10.6
Nb–Ti	302.0±0.1
Nb–V	369.3±0.1
Nd–Nd	82.8
Nd–O	703
Nd–S	471.5±14.6
Nd–Se	393.9
Nd–Te	305±15
Ne–Ne	4.070
Ne–Xe	4.31
Ne–Zn	3.92
Ni–Ni	204
Ni–O	366±30
Ni–Pd	140.9
Ni–Pt	273.7±0.3
Ni–S	356±21
Ni–Si	318±17
Ni–V	206.3±0.2
Ni–Y	283.92±0.10
Ni–Zr	279.8±0.1
No–O	268
Np–O	731
O–O	498.36±0.17
O–Os	575
O–P	589
O–Pa	792
O–Pb	374
O–Pd	238.1±12.6
O–Pr	740
O–Pt	391±42
O–Pu	656.1
O–Rb	276±12.6
O–Re	627±84
O–Rh	405±42
O–Ru	528±42
O–S	517.90±0.05
O–Sb	434±42
O–Sc	671.4±1.0
O–Se	429.7±6.3
O–Si	799.6±13.4
O–Sm	573
O–Sn	528
O–Sr	426.3±6.3
O–Ta	839
O–Tb	694
O–Tc	548
O–Te	377±21
O–Th	877
O–Ti	668
O–Tl	213±84
O–Tm	514
O–U	755
O–V	637
O–W	720±71
O–Xe	36.4
O–Y	714.1±10.2
O–Yb	387.7±10
O–Zn	≤250
O–Zr	766.1±10.6
Os–Os	415±77
P–P	489.1
P–Pt	≤416.7±16.7
P–Rh	353.1±16.7
P–S	442±10
P–Sb	356.9±4.2
P–Se	363.7±10.0
P–Si	363.6
P–Te	297.9±10.0
P–Th	372±29
P–Tl	209±13
P–U	293±21
P–W	305±4
Pb–Pb	86.6±0.8
Pb–S	398
Pb–Sb	161.5±10.5
Pb–Se	302.9±4.2
Pb–Te	249.8±10.5
Pd–Pd	>136
Pd–Pt	191.0
Pd–Si	261±12
Pd–Y	241±15
Po–Po	187
Pr–Pr	129.1
Pr–S	492.5±4.6
Pr–Se	446.4±23.0
Pr–Te	326±20
Pt–Pt	306.7±1.9
Pt–Si	501±18
Pt–Th	551±42
Pt–Ti	397.5±10.6
Pt–Y	474±12
Rb–Rb	48.898±0.005
Re–Re	432±30
Rh–Rh	235.85±0.05
Rh–Sc	444±11
Rh–Si	395.0±18.0
Rh–Th	513±21
Rh–Ti	390.8±14.6
Rh–U	519±17
Rh–V	364±29
Rh–Y	446±11
Ru–Ru	193.0±19.3
Ru–Si	397.1±21
Ru–Th	592±42
Ru–V	414±29
S–S	425.30
S–Sb	378.7
S–Sc	478.2±12.6
S–Se	371.1±6.7
S–Si	617±5
S-Sm	389
S–Sn	467
S–Sr	338.5±16.7
S–Ta	669.5±13.5
S–Tb	515±42
S–Te	335±42
S–Ti	418±3
S–Tm	368±21
S–U	528.4±10.5
S–V	449.4±14.6
S–Y	528.4±10.5
S–Yb	167
S–Zn	224.8±12.6
S–Zr	572.0±11.6
Sb–Sb	301.7±6.3
Sb–Te	277.4±3.8
Sb–Tl	126.7±10.5
Sc–Sc	163±21
Sc–Se	385±17
Sc–Si	227.2±14
Sc–Te	289±17
Se–Se	330.5
Se–Si	538±13
Se–Sm	331.0±14.6
Se–Sn	401.2±5.9
Se–Sr	251.0±12.6
Se–Tb	423±20

A-B	D^o_{298}/kJ mol^{-1}	A-B	D^o_{298}/kJ mol^{-1}	A-B	D^o_{298}/kJ mol^{-1}	A-B	D^o_{298}/kJ mol^{-1}
Se–Te	293.3	Sm–Te	272.4±14.6	Te–Ti	289±17	Tm–Tm	54±17
Se–Ti	381±42	Sn–Sn	187.1±0.3	Te–Tm	182±40	U–U	222±21
Se–Tm	274±40	Sn–Te	338.1±6.3	Te–Y	339±13	V–V	269.3±0.1
Se–V	347±21	Sr–Sr	16.64±1.12	Te–Zn	117.6±18.0	V–Zr	260.6±0.3
Se–Y	435±13	T–T	446.67	Th–Th	≤289±33	W–W	666
Se–Zn	170.7±25.9	Ta–Ta	390±96	Ti–Ti	117.6	Xe–Xe	6.023
Si–Si	310	Tb–Tb	138.8	Ti–V	203.2±0.1	Y–Y	~270±39
Si–Te	448±8	Tb–Te	339±42	Ti–Zr	214.3±0.1	Yb–Yb	16.3
Si–Y	258±17	Tc–Tc	330	Tl–Tl	59.4	Zn–Zn	22.2±6.3
Sm–Sm	54±21	Te–Te	257.6±4.1	Tl–Xe	4.18	Zr–Zr	298.2±0.1

TABLE 2. Enthalpy of Formation of Gaseous Atoms

Atom	$\Delta_f H^o_{298}$/kJ mol^{-1}	Ref.	Atom	$\Delta_f H^o_{298}$/kJ mol^{-1}	Ref.	Atom	$\Delta_f H^o_{298}$/kJ mol^{-1}	Ref.
Ac	406	5	Gd	397.5±2.1	4	Pu	345	6
Ag	284.9±0.8	2	Ge	372±3	2	Ra	159	5
Al	330.9±4.0	2	H	217.998±0.006	2	Rb	80.9±0.8	2
Am	284	6	Hf	618.4±6.3	3	Re	774±6.3	1
As	302.5±13	1	Hg	61.38±0.04	2	Rh	556±4	1
Au	368.2±2.1	1	Ho	300.6±2.1	4	Ru	650.6±6.3	1
B	565±5	2	I	106.76±0.04	2	S	277.17±0.15	2
Ba	179.1±5.0	3	In	243±4	1	Sb	264.4 ±2.5	1
Be	324±5	2	Ir	669±4	1	Sc	377.8±4	1
Bi	209.6±2.1	1	K	89.0±0.8	2	Se	227.2±4	1
Bk	310	6	La	431.0±2.1	4	Si	450.0±8	2
Br	111.87±0.12	3	Li	159.3±1.0	2	Sm	206.7±2.1	4
C	716.68±0.45	2	Lu	427.6±2.1	4	Sn	301.2±1.5	2
Ca	177.8±0.8	2	Mg	147.1±0.8	2	Sr	164.0±1.7	3
Cd	111.80±0.20	2	Mn	283.3±4.2	3	Ta	782.0±2.5	1
Ce	420.1±2.1	4	Mo	658.98±3.8	3	Tb	388.7±2.1	4
Cf	196	6	N	472.68±0.40	2	Tc	678	5
Cl	121.301±0.008	2	Na	107.5±0.7	3	Te	196.6±2.1	1
Cm	386	6	Nb	733.0±8	3	Th	602±6	2
Co	426.7	3	Nd	326.9±2.1	4	Ti	473±3	2
Cr	397.48±4.2	3	Ni	430.1±8.4	3	Tl	182.2±0.4	1
Cs	76.5±1.0	2	Np	464.8	6	Tm	232.2±2.1	4
Cu	337.4±1.2	2	O	249.18±0.10	2	U	533±8	2
Dy	290.4±2.1	4	Os	787±6.3	1	V	515.5±8	3
Er	316.4±2.1	4	P	316.5±1.0	2	W	851.0±6.3	3
Es	133	6	Pa	563	5	Y	424.7±2.1	4
Eu	177.4±2.1	4	Pb	195.2±0.8	2	Yb	155.6±2.1	4
F	79.38±0.30	2	Pd	376.6±2.1	1	Zn	130.40±0.40	2
Fe	415.5±1.3	3	Pr	356.9±2.1	4	Zr	610.0±8.4	3
Ga	271.96±2.1	3	Pt	565.7±1.3	1			

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TABLE 3. Bond Dissociation Energies in Polyatomic Molecules

The D^o_{298} values in polyatomic molecules are notoriously difficult to measure accurately since the mechanism of the kinetic systems involved in many of the measurements are seldom straightforward. Thus, much lively controversy has taken place in the literature and is likely to continue for some time to come. We will keep on updating and presenting our assessment of the most reliable BDE data every year.

The references relating to each of the D^o_{298} values listed in Table 3 are contained in the *Comprehensive Handbook of Chemical Bond Energies*, by Yu-Ran Luo, Taylor & Francis, 2006. Many D^o_{298} in Table 3 are derived from the equation

$$D^o_{298}(\text{R-X}) = \Delta_f H^o(\text{R}) + \Delta_f H^o(\text{X}) - \Delta_f H^o(\text{RX})$$

Here, the enthalpies of formation of the atoms and radicals are taken from Tables 2 and 4, respectively, and the enthalpies of formation of the molecules are from reference sources listed in the above Comprehensive Handbook of Chemical bond Energie.

Table 3 presents H-C, C-C, C-halogen, O-, N-, S-, Si-, Ge-, Sn-, Pb-, P-, As-, Sb-, Bi-, Se-, Te-, and metal-X BDEs. The boldface in the species indicates the dissociated fragment. The metal-X BDEs are arranged on the basis of the Periodic Table with the new IUPAC notation for Groups 1 to 18, see inside front cover of this Handbook.

Bond	D^o_{298}/ kJ mol^{-1}
(1) C–H BDEs	
CH_3–**H**	439.3 ±0.4
CH_3CH_2–**H**	420.5±1.3
$CH_3CH_2CH_2$–**H**	422.2±2.1
$CH_3C\mathbf{H}_2CH_3$	410.5±2.9
$CH_3CH_2CH_2CH_2$–**H**	421.3
$CH_3C\mathbf{H}_2CH_2CH_3$	411.1±2.2
$(CH_3)_2CHCH_2$–**H**	419.2±4.2
$(CH_3)_3C$–**H**	400.4±2.9
$(CH_3)_3CCH_2$–**H**	419.7±4.2
$(CH_3CH_2)C\mathbf{H}(CH_3)_2$	400.8
$CH_3C\mathbf{H}_2(CH_2)_2CH_3$	415.1
$(C_3H_7)C\mathbf{H}(CH_3)_2$	396.2±8.4
$CH_3CH(CH_3)C\mathbf{H}(CH_3)_2$	399.2±13.0
$CH_3C\mathbf{H}_2(CH_2)_3CH_3$	410
$CH_3C\mathbf{H}_2(CH_2)_4CH_3$	410
HCC–**H**	557.81±0.30
HCCCC–**H**	539±12
$CHCCH_2$–**H**	372.0±4.2
CH_3CCCH_2–**H**	379.5
$HCCC\mathbf{H}_2CH_3$	373.0
CH_2=$CHCCCH_2$–**H**	363.3
$CH_3CCC\mathbf{H}_2CH_3$	365.3±9.6
$HCCC\mathbf{H}_2CH_2CH_3$	349.8±8.4
$HCCC\mathbf{H}(CH_3)_2$	345.2±8.4
$CH_3CCC\mathbf{H}(CH_3)_2$	344.3±11.3
HCCCCCC–**H**	~543±13
H_2C=CH–**H**	464.2±2.5
CH_2=C=CH–**H**	371.1±12.6
CH_3CH=CH–**H**	464.8
CH_2=$CHCH_2$–**H**	369±3
CH_2=CH-CH_2CH_2–**H**	410.5
CH_2=$CHC\mathbf{H}_2CH_3$	350.6
CH_2=$C(CH_3)CH_2$-**H**	372.8
CH_2=CHCH=$CHCH_2$-**H**	347.3±12.6
$(CH_2$=$CH)_2CH$–**H**	320.5±4.2
CH_2=$CHC\mathbf{H}_2CH_2CH_3$	348.8
CH_2=$CHC\mathbf{H}(CH_3)_2$	332.6±7.1
CH_2=$C(CH_3CH_2)CH_2$–**H**	356.1±8.4
$(CH_2$=$CH)_2C(CH_3)$–**H**	322.2
H-*cyclo*-C_3H_5	444.8±1.0
H-CH_2-*cyclo*-C_3H_5	407.5±6.7
H-*cyclo*-C_4H_7	409.2±1.3
H-*cyclo*-C_5H_9	400.0±4.2
H-*cyclo*-C_6H_{11}	416.3
H–C_6H_5	472.2±2.2
H–$CH_2C_6H_5$	375.5±5.0
H–$CH(CH_3)C_6H_5$	357.3±6.3
H–$CH(C_6H_5)_2$	353.5±2.1
H–$CH(C_6H_4$-p-$OH)_2$	375.8±4.7
H–$C(CH_3)_2C_6H_5$	348.1±4.2
H–$C(C_6H_5)_3$	338.9±8.4
1-**H**-C_8H_7	469.4±5.4
2-**H**-C_8H_7	468.2±5.9
H–CF_3	445.2±2.9
H–CHF_2	431.8±4.2
H–CH_2F	423.8±4.2
H–$CClF_2$	421.3±8.4
H–CCl_2F	410.9±8.4
H–$CBrF_2$	415.5±12.6
H–CHClF	421.7±10.0
H–CCl_3	392.5±2.5
H–$CHCl_2$	407.1±4.2
H–CH_2Cl	419.0±2.3
H–CFClBr	413±21
H–CHClBr	406.0±2.4
H–CCl_2Br	387±21
H–$CClBr_2$	371±21
H–CBr_3	399.2±8.4
H–$CHBr_2$	417.1±7.5
H–CH_2Br	427.2±2.4
H–CI_3	423±29
H–CHI_2	431.0±8.4
H–CH_2I	431.6±2.8
CF_3CF_2–**H**	429.7±2.1
CHF_2CF_2–**H**	431.0±18.8
CH_2FCF_2–**H**	433.0±14.6
CHF_2CFH–**H**	426.8±14.6
CF_3CH_2–**H**	446.4±4.5
CH_3CF_2–**H**	416.3±4.2
CH_2FCHF–**H**	413.4±12.6
CHF_2CH_2–**H**	433.0±14.6
CH_2FCH_2–**H**	433.5±8.4
CH_3CHF–**H**	410.9±8.4
CF_3CHCl–**H**	425.9±6.3
CF_3CClBr–**H**	404.2±6.3
$CClF_2CHF$–**H**	412.1±2.1
CCl_3CCl_2–**H**	397.5±8.4
$CHCl_2CCl_2$–**H**	393.3±8.4
CH_3CCl_2–**H**	397.9±5.0
CH_3CHCl–**H**	406.6±1.5
CH_2ClCH_2–**H**	423.1±2.4
CH_3CBr_2–**H**	397.1±5.0
CH_2BrCH_2–**H**	415.1±8.4
CH_3CHBr–**H**	406.7±4.2
CF_2=CF–**H**	464.4±8.4
$CF_3CF_2CF_2$–**H**	432.2
CH_3CH_2CHCl–**H**	407.0±3.5
CH_2=CH-CHF–**H**	370.7±4.6
CH_2=$CHCHCl$–**H**	370.7±4.6
CH_2=$CHCHBr$–**H**	374.0±4.6
H–C_6F_5	487.4
H–CH_2OH	401.92±0.63
$C\mathbf{H}_2CHOH$	467±11
$CH_3C\mathbf{H}_2OH$	401.2±4.2
$C\mathbf{H}_3CH_2OH$	421.7±8
$CH_3CH_2C\mathbf{H}_2OH$	392
$CH_3C\mathbf{H}_2CH_2OH$	394.6±8.4
$C\mathbf{H}_3CH_2CH_2OH$	406.3±8.4

Bond	D^o_{298}/ kJ mol^{-1}
$(CH_3)_2$**C**H**O**H	383.7±8.4
$(C$**H**$_3)_2$CHOH	394.6±8.4
CH_2=CHC**H**$_2$OH	341.4±7.5
$(C$**H**$_3)_3$COH	418.4±8.4
$(CH_2$=CH$)_2$C**H**OH	288.7
Ph_2C**H**OH	326
CH_3C**H**$(OH)_2$	~ 385
$(C$**H**$_2$OH$)_2$	385.3
HOC$H_2(CH_2)_2$(OH)CH–**H**	399.2
C**H**$_3$OCH_3	402.1
C**H**F_2OCF_3	443.5±4.2
C**H**F_2OCHF_2	435.1±4.2
C**H**$_3$OCF_3	426.8±4.2
C**H**$_3$OCH_2CH_3	389.1
$(CH_3)_3$COC$(C$**H**$_3)_3$	402.1
CH_3C**H**$_2$OCH_2CH_3	389.1
CH_3C**H**$_2$Ot-C$(CH_3)_3$	405.4
C**H**$_3$OPh	385.0
H-2-oxiran-2-yl	420.5±6.5
H-tetrahydrofuran-2-yl	385.3±6.7
HC(O)–**H**	368.40±0.67
FC(O)–**H**	423.0
CH_3C(O)–**H**	374.0±1.3
CF_3C(O)–**H**	390.4
C_2H_5C(O)–**H**	374.5
CH_2=CHC(O)–**H**	372.8
C_3H_7C(O)–**H**	371.2
iso-C_3H_7C(O)–**H**	364.5
C_4H_9C(O)–**H**	372.0
$(CH_3)_2$CHCH_2C(O)–**H**	362.5
C_2H_5CH(CH_3)C(O)–**H**	360.8
tert-BuC(O)–**H**	375.1
Et_2CHC(O)–**H**	367.2
$CH_3(CH_2)_8$C(O)–**H**	373.3
C_6H_5C(O)–**H**	371.1±10.9
PhCH_2C(O)–**H**	362.0
PhC$(CH_3)_2$C(O)–**H**	362.9
H–CH=C=O	448.1
C**H**$_3$C(O)H	394.5±9.2
C**H**$_3$C(O)Cl	≤423.4
CH_3C**H**$_2$C(O)H	383.7
C**H**$_3$COCH_3	401.2±2.9
CF_3C(O)C**H**$_3$	465.6
C**H**$_3$COCH_2CH_3	403.8
MeCOC**H**$_2$Me	386.2±7.1
EtCOC**H**$_2$Me	396.5±2.8
C**H**$_3$CH_2COC_6H_5	402.8±3.6
MeC**H**$_2$COPh	388.7
H–C(O)OH	404.2

Bond	D^o_{298}/ kJ mol^{-1}
C**H**$_3$C(O)OH	398.7±12.1
ClC**H**$_2$C(O)OH	398.9
H–C(O)OCH_3	399.2±8.4
C**H**$_3$C(O)OCH_3	406.3±10.5
CH_3C(O)OC**H**$_3$	404.6
C**H**$_3$C(O)OCH_2CH_3	401.7
C**H**$_3$C(O)OPh	419.2±5.4
CH_3C**H**$_2$C(O)OEt	400
PhC**H**$_2$C(O)OEt	370.7
Me_2C**H**C(O)OEt	387.4
PhC**H**Me(C(O)OEt)	358.2
H-furaylmethyl	361.9±8.4
C**H**$_3$NH_2	392.9±8.4
C**H**$_3$N=CH_2	407.9±14.6
CH_3C**H**$_2$NH_2	377.0±8.4
C_2H_5C**H**$_2$NH_2	380.7±8.4
C_3H_7C**H**$_2$NH_2	393.3±8.4
C_4H_9C**H**$_2$NH_2	387.7±8.4
HOCH_2C**H**$_2$NH_2	379.5±8.4
$(CH_3C$**H**$_2)_2$NH	370.7±8.4
$(C_3H_7C$**H**$_2)_2$NH	379.9±8.4
$(C_4H_9C$**H**$_2)_2$NH	384.5±8.4
$(C_2H_5)_2$NC**H**$_2$CH_3	379.5±1.7
$(C_2H_5C$**H**$_2)_3$N	376.6±8.4
$((CH_3)_2CC$**H**$_2)_3$N	388.3±8.4
$(Bu)_2$NC**H**$_2$(nPr)	381±10.0
$((CH_3)_2C$**H**$)_3$N	387.0±8.4
$(CH_3)_2$**CH**NH_2	372.0±8.4
C**H**$_3$NHCH_3	364.0±8.4
$(C$**H**$_3)_3$N	380.7±8.4
tert-BuN$(C$**H**$_3)_2$	376.6±8.4
$((HOCH_2C$**H**$_2)_2(CH_3))$N	364.4±8.4
$(HOCH_2C$**H**$_2)_3$N	379.9±8.4
$((HOCH_2)C$**H**$(CH_3))_3$N	379.9±8.4
PhC**H**$_2$NH_2	368.2
PhN$(C$**H**$_2CH_3)_2$	383.3±4.2
Ph_2NC**H**$_3$	379.5±1.7
PhN$(C$**H**$_2$Ph$)_2$	357.3±8.8
N$(C$**H**$_2$Ph$)_3$	372.8±2.5
PhN$(C$**H**$_2$CH=C$H_2)_2$	339.3±2.9
N$(C$**H**$_2$CH=C$H_2)_3$	345.6±3.3
H_2NNH$(C$**H**$_3)$	410
HNN$(C$**H**$_3)_2$	410
$(C$**H**$_3)_2$NC_6H_5	383.7±5.4
H–CN	528.5±0.8
C**H**$_3$CN	405.8±4.2
CH_3C**H**$_2$CN	393.3±12.6
PhC**H**$_2$CN	344.3
C_6F_5C**H**$_2$CN	350.6

Bond	D^o_{298}/ kJ mol^{-1}
C**H**$_2(CN)_2$	366.5
C**H**$_2$(CN)(NH_2)	355.2
$(CH_3)_2$C**H**CN	384.5
C**H**$_3$NC	389.1±12.6
H–HCNN	405.8±8.4
H–CNN	331±17
C**H**$_3NO_2$	415.4
CH_3C**H**$_2NO_2$	410.5
C_2H_5C**H**$_2NO_2$	410.5
Me_2C**H**NO_2	394.9
$C_6H_5C(NO_2)$C**H**CH_3	357.3
H–C(S)H	399.6±5.0
C**H**$_3$SH	392.9±8.4
CH_3SC**H**$_3$	392.0±5.9
PhSC**H**$_3$	389.1
PhC**H**$_2$SPh	352.3
$(PhS)_2$C**H**Ph	341.0
PhSC**H**Ph_2	344.8
C**H**$_3$SOCH_3	393.3
C**H**$_3SO_2CH_3$	414.2
C**H**$_3SO_2CF_3$	431.0
C**H**$_3SO_2$Ph	414.2
PhC**H**$_2SO_2$Me	380.7
PhC**H**$_2SO_2CF_3$	372.4
PhC**H**$_2SO_2$tBu	376.6
Ph_2C**H**SO_2Ph	365.3
C**H**$_2(SPh)_2$	372.4
H–CH_2SiMe_3	418±6.3
H–C$H_2C(CH_3)_2SiMe_3$	409±5
H–CH_2SiMe_2Ph	410.1
H–CH$((CH_3)_3Si)_2$	397±13
H–C$H_2B(RO)_2$	412.5
H–CH$((CH_3)_2P)_2$	385±13
(2) C–C BDEs	
CH$_3$–CH_3	377.4±0.8
CH$_3$–C$_2$H$_5$	370.3±2.1
CH$_3$–C$_3$H$_7$	372.0±2.9
CH$_3$–*iso*-C$_3$H$_7$	369.0±3.8
CH$_3$–C$_4$H$_9$	371.5±2.9
CH$_3$–*iso*-C$_4$H$_9$	370.3±4.6
CH$_3$–*sec*-C$_4$H$_9$	368.2±2.9
CH$_3$–*tert*-C$_4$H$_9$	363.6±2.9
CH$_3$–C$_5$H$_{11}$	368.4±6.3
CH$_3$–CH$(C_2H_5)_2$	365.7±4.2
CH$_3$–C$(CH_3)_2(CH_2CH_3)$	360.9±6.3
CH$_3$–C$_6$H$_{13}$	368.2±6.3
C$_2$H$_5$–C$_2$H$_5$	363.2±2.5
C$_3$H$_7$–C$_3$H$_7$	366.1±3.3

Bond	D^o_{298}/ kJ mol^{-1}
***iso*-C_3H_7–*iso*-C_3H_7**	353.5±4.6
C_4H_9–C_4H_9	364.0±3.8
***iso*-C_4H_9–*iso*-C_4H_9**	362.3±6.3
***sec*-C_4H_9–*sec*-C_4H_9**	348.5±3.3
***tert*-C_4H_9–*tert*-C_4H_9**	322.6±4.2
CH_3–*cyclo*-C_5H_9	358.2±5.0
CH_3–*cyclo*-C_6H_{11}	377.0±7.5
***cyclo*-C_6H_{11}–*cyclo*-C_6H_{11}**	369.0±8.4
CH_3–$CH_2C{\equiv}CH$	320.5±5.0
CH_3–$CH_2C{\equiv}CCH_3$	308.4±6.3
CH_3–$CH(CH_3)C{\equiv}CH$	305.4±8.4
CH_3–$CH(CH_3)C{\equiv}CCH_3$	320.9±6.3
CH_3–$C(CH_3)_2C{\equiv}CH$	295.8±6.3
CH_3–$C(CH_3)_2C{\equiv}CCH_3$	303.3±6.3
CH_3–$CHCH_2$	426.3±6.3
CH_3–$CH{=}CCH_2$	359.8±5.9
CH_3–cyclopro-en-1-yl	340.6±20.9
CH_3–$CH_2CH{=}CH_2$	317.6±3.8
CH_3–$CH_2C(CH_3){=}CH_2$	310.0±4.2
CH_3–$CH(CH_3)CH{=}CH_2$	302.5±6.3
CH_3–$C(CH_3)_2CH{=}CH_2$	282.4±6.3
CH_3–*cyclo*-C_5H_7	299.2±8.4
CH_3–C_6H_5	426.8±4.2
HCC–C_6H_5	590.8±5.9
C_2H_3–C_6H_5	482.0±5.4
CH_3-$CH_2C_6H_5$	325.1±4.2
CH_3–$CH(CH_3)C_6H_5$	318.8±8.4
CH_3–$C(CH_3)_2C_6H_5$	303.3±8.4
CH_3–$CH_2CHCHPh$	295.4
CH_3–$CH(C_6H_5)_2$	315.9±6.3
CH_3–$C(CH_3)(C_6H_5)_2$	290.8±8.4
C_6H_5–C_6H_5	478.6±6.3
C_6H_5–$CH_2C_6H_5$	383.7±8.4
$C_6H_5CH_2$–$CH_2C_6H_5$	272.8±9.2
C_6H_5–$CH(C_6H_5)_2$	361.1±8.4
C_6H_5–$C(C_6H_5)_3$	324.3±12.6
Ph_2CH–$CHPh_2$	247.3±8.4
$PhCH_2$–CPh_3	234.7±14.6
R-R, R = phenalenyl	42
R-R, R = 9-phenylfluorenyl	63.6
CF_3–CF_3	413.0±5.0
CF_3–CHF_2	399.6±8.4
CF_3–$CClF_2$	373.6±12.5
CF_3–CH_2F	397.5±8.4
CF_3–CCl_3	332.2±5.4
CF_3–CHBrCl	377.0±10.5
CF_3–CH_2Br	399.6±8.4
CF_3–CH_2I	408.4±10.5
CF_3–CH_3	429.3±5.0

Bond	D^o_{298}/ kJ mol^{-1}
CHF_2–CHF_2	382.4±15.5
$CClF_2$–$CClF_2$	378.7±12.6
CF_2Cl–$CFCl_2$	358.6±12.6
CHF_2–CH_2F	394.1±16.7
CH_2F–CH_2F	368.2±8.4
CHF_2–CH_3	405.0±8.4
CH_2F–CH_3	388.3±8.4
CHClF–CH_3	399.6±12.6
CF_2Br–CHClF	369.4
CF_2Br–CH_3	396.6±15.1
CCl_3–CCl_3	285.8±6.3
CCl_3–$CClF_2$	282.0±12.6
CCl_3–$CHCl_2$	306.3±8.4
CCl_3–CH_2Cl	323.8±8.4
CCl_3–CH_3	362.3±6.3
$CHCl_2$–$CHCl_2$	342.3±8.4
$CHCl_2$–CH_2Cl	358.6±8.4
$CHCl_2$–CH_3	365.1±3.3
CHBrCl–CH_3	384.5
CHClBr–CHClBr	323.0±12.6
CH_2Cl–CH_2Cl	360.7±8.4
CH_2Cl–CH_3	375.7±9.2
Br_3C–CH_3	356.9±12.6
Br_3C–CBr_3	278.7±16.7
$CHBr_2$–CH_3	372.8
CH_2Br–CH_2Cl	378.2
CH_2Br–CH_2Br	379.9±8.4
CH_2I–CH_2I	387.0±10.5
CH_3–CH_2Br	381.6±8.4
CH_3–CH_2I	384.5±8.4
CF_3–CF_2CF_3	424.3±13.6
CF_3–$CF{=}CF_2$	420.5
CH_3–CH_2CH_2Cl	371.4±2.8
CH_3–$CHClCH_3$	367.5±2.0
CH_2Cl–$CHClCH_3$	356.5±8.4
CH_2Cl–CH_2CClH_2	369.0±8.4
CH_3–CCl_2CH_3	362.8±8.4
CH_2Br–$CHBrCH_3$	369.4±8.4
CH_2ClCH_2–$CHClCH_3$	364.4±8.4
CH_2ClCH_2–CH_2CClH_2	369.0±8.4
CH_3CHBr–$CHBrCH_3$	355.6±8.4
CF_3–C_6H_5	463.2±12.6
CCl_3–C_6H_5	388.7±8.4
CH_3–C_6F_5	439.3
CF_3–C_6F_5	435.1
CF_3–$CH_2C_6H_5$	365.7±12.6
C_6F_5–C_6F_5	488.3
CF_3–$CHPh_2$	352.3±16.7
CF_3–CPh_3	290.8±16.7

Bond	D^o_{298}/ kJ mol^{-1}
CF_2CF–$CFCF_2$	558.1±12.6
CH_2FCH_2–CPh_3	274.9±16.7
CHF_2CH_2–CPh_3	264.0±16.7
CH_3–CH_2OH	364.8±4.2
CF_3–CH_2OH	405.4±6.3
C_2H_5–CH_2OH	356.9±5.0
C_3H_7–CH_2OH	357.3±3.3
***iso*-C_3H_7–CH_2OH**	354.8±4.2
C_4H_9–CH_2OH	355.6±4.2
***sec*-C_4H_9–CH_2OH**	352.7±4.2
***iso*-C_4H_9–CH_2OH**	354.0±5.4
C_6H_5–CH_2OH	413.4±5.4
HOH_2C–CH_2OH	358.2±6.3
NH_2CH_2–CH_2OH	335.6±10.5
CH_3–CH_2OCH_3	363.2±5.0
CH_3OCH_2–CH_2OCH_3	338.9±10.5
CH_3–C(O)H	354.8±1.7
CCl_3–C(O)H	309.2±5.0
CH_3–C(O)F	417.6±6.3
CH_3–C(O)Cl	367.8±6.3
CCl_3–C(O)Cl	289.1±6.3
$CHCl_2$–C(O)Cl	312.5±8.4
$CClH_2$–C(O)Cl	340.2±8.4
C_6H_5–C(O)H	408.4±4.2
C_6H_5–C(O)Cl	417.6±6.3
CH_3–$C(O)CH_3$	351.9±2.1
C_2H_5–$C(O)CH_3$	347.3±2.9
C_3H_7–$C(O)CH_3$	348.5±2.9
***iso*-C_3H_7–$C(O)CH_3$**	340.2±3.8
C_4H_7–$C(O)CH_3$	346.9±5.4
***tert*-C_4H_9–$C(O)CH_3$**	329.3±4.2
C_6H_5–$C(O)CH_3$	406.7±4.6
$C_6H_5CH_2$–$C(O)CH_3$	299.7±8.4
HC(O)–C(O)H	295.8±6.3
ClC(O)–C(O)Cl	292.5±8.4
$CH_3C(O)$–C(O)H	302.5±8.4
$CH_3C(O)$–$C(O)CH_3$	307.1±4.2
$C_6H_5C(O)$–$C(O)C_6H_5$	288.3±16.7
CH_3–C(O)OH	384.9±8.4
CF_3–C(O)OH	370.7±8.4
CCl_3–C(O)OH	310.5±12.6
$CClH_2$–C(O)OH	357.7±8.4
CH_2Br–C(O)OH	358.2±8.4
NH_2CH_2–C(O)OH	349.4±8.4
CH_3NHCH_2–C(O)OH	300.4±8.4
C_6H_5–C(O)OH	429.7±8.4
C_6F_5–C(O)OH	470.0±10.5
$HOCH_2$–C(O)OH	371.5±5.4
HOC(O)–C(O)OH	334.7±6.3

Bond	D^o_{298}/ kJ mol^{-1}
CH_3NHCH_2–C(O)OH	301.2±16.7
$CH_3CH(NH_2)$–C(O)OH	331.4±16.7
NH_2CH_2–CH_2C(O)OH	325.5±16.7
CN–**CN**	571.9±6.7
HC(O)–**CN**	455.2±8.4
HC(S)–**CN**	530.1±8.4
CF_3–**CN**	469.0±4.2
CH_3–**CN**	521.7±9.2
NCC–**CN**	462.3
C_2H_5–**CN**	506.7±7.5
CH_3–CH_2CN	348.1±12.6
C_6H_5–CH_2CN	386.6±8.4
CH_3–$CH(CH_3)$CN	332.6±8.4
CH_3–$C(CH_3)_2$CN	340.6±16.7
CH_3–$C(CH_3)(CN)C_6H_5$	250.6
$(Ph)_2(CN)C$–$C(CN)(Ph)_2$	109.6
$(NO_2)_3C$–$C(NO_2)_3$	308.8
C_{58}–C_2	955.2±14.5
(3) C–halogen BDEs	
F–CN	482.8
F–CF_3	546.8±2.1
F–CHF_2	533.9±5.9
F–CH_2F	496.2±8.8
F–CF_2Cl	511.7
F–$CFCl_2$	482.0±10.5
F–CHFCl	462.3±10.0
F–CCl_3	439.3±4
F–CH_2Cl	465.3±9.6
F–CH_3	460.2±8.4
F–C≡CH	521.3
F–C≡CF	519±21
F–CF=CF_2	546.4±12.6
F–CF_2CF_3	532.2±6.3
F–CH_2CF_3	457.7
F–CF_2CH_3	522.2±8.4
F–C_2H_3	517.6±12.6
F–C_2H_5	467.4±8.4
F–C_3H_7	474.9±8.4
F–*iso*-C_3H_7	483.8±8.4
F–*tert*-C_4H_9	495.8±8.4
F–C_6H_5	525.5±8.4
F–C_6F_5	485±25
F–$CH_2C_6H_5$	412.8±4.2
F–COH	497.9±10.5
F–COF	510.3
F–COCl	484.5
F–$C(O)CH_3$	511.7±12.6
Cl–CN	422.6±8.4
Cl–CF_3	365.3±3.8
Cl–CHF_2	364±8
Cl–CH_2F	354.4±11.7
Cl–CF_2Cl	333.9±10.5
Cl–$CFCl_2$	320.9±8.4
Cl–CHFCl	346.0±13.4
Cl–CCl_3	296.6
Cl–$CHCl_2$	320.5±6.3
Cl–CH_2Cl	338.0±3.3
Cl–$CBrCl_2$	287±10.5
Cl–CH_2Br	332.8±4.6
Cl–CH_2I	328.2±6.9
Cl–CH_3	350.2±1.7
Cl–C≡CCl	443±50
Cl–C≡CH	435.6±8.4
Cl–CH_2CN	267.4
Cl–CCl=CCl_2	383.7
Cl–CH=CH_2	396.5±4.8
Cl–CF=CF_2	434.7±8.4
Cl–CF_2CF_3	346.0±7.1
Cl–CF_2CF_2Cl	331.4±20.9
Cl–CCl_2CF_3	307.9
Cl–CCl_2CCl_3	303.8
Cl–$CHClCCl_3$	330.5±4.2
Cl–CCl_2CHCl_2	311.7
Cl–$CHClCH_3$	327.9±1.8
Cl–CH_2CH_2Cl	345.1±5.0
Cl–$CHBrCH_3$	331.8±8.4
Cl–CH_2CH_3	352.3±3.3
Cl–CH_2CH=CH_2	298.3±5.0
Cl–C_3H_7	352.7±4.2
Cl–$CH_2CH_2CH_2Cl$	348.9
Cl–*iso*-C_3H_7	354.0±6.3
Cl–CH_2CHCH=CH_2	342.7
Cl–C_4H_9	350.6±6.3
Cl–*sec*-C_4H_9	350.2±6.3
Cl–*tert*-C_4H_9	351.9±6.3
CH_2CHCH**Cl**(CH_3)	300.0±6.3
Cl–C_5H_{11}	350.6±6.3
Cl–$C(CH_3)_2(C_2H_5)$	352.7±6.3
Cl–*cyclo*-C_6H_{11}	360.2±6.5
Cl–C_6H_5	399.6±6.3
Cl–C_6F_5	383.3±8.4
Cl–$CH_2C_6H_5$	299.9±4.3
Cl–C(O)Cl	318.8±8.4
Cl–COF	376.6
Cl–$C(O)CH_3$	354.0±8.4
Cl–$C(O)CH_2CH_3$	353.3±6.3
Cl–$C(O)C_6H_5$	341.0±8.4
Cl–$CH_2C(O)C_6H_5$	309
Cl–$CH_2C(O)OH$	310.9±2.2
Cl–$C(O)OC_6H_5$	364
Cl–$C(NO_2)_3$	302.1
Br–CN	364.8±4.2
Br–CF_3	296.2±1.3
Br–CHF_2	288.7±8.4
Br–CF_2Cl	269.9±6.3
Br–CCl_3	231.4±4.2
Br–CH_2Cl	277.3±3.6
Br–CBr_3	242.3±8.4
Br–$CHBr_2$	274.9±13.0
Br–CH_2Br	276.1±5.3
Br–CH_2I	274.5±7.5
Br–CH_3	294.1±2.1
Br–C≡CH	410.5
Br–CH=CH_2	338.3±3.1
Br–CF_2CF_3	283.3±6.3
Br–$CClBrCF_3$	251.0±6.3
Br–CF_2CF_2Br	282.8±6.7
Br–$CHClCF_3$	274.9±6.3
Br–CF_2CH_3	287.0±5.4
Br–CH_2CH_2Cl	292.5±8.4
Br–$CHClCH_3$	272.0±8.4
Br–C_2H_5	292.9±4.2
Br–CH_2CH=CH_2	237.2±5.0
Br–C_3H_7	298.3±4.2
Br–*iso*-C_3H_7	299.2±6.3
Br–$CH_2CH_2CH_2Br$	324.7
Br–$CF_2CF_2CF_3$	278.2±10.5
CF_3CF**Br**CF_3	274.2±4.6
Br–C_4H_9	296.6±4.2
Br–*sec*-C_4H_9	300.0±4.2
Br–*tert*-C_4H_9	292.9±6.3
Br–C_6H_5	336.4±6.3
Br–C_6F_5	~328
Br-$CH_2C_6H_5$	239.3±6.3
Br–$CH_2C_6F_5$	225.1±6.3
Br–1–$C_{10}H_7$	339.7
Br–2–$C_{10}H_7$	341.8
Br–anthracenyl	322.6
Br–$C(O)CH_3$	292.0±8.4
Br–$C(O)C_6H_5$	276.6±8.4
Br–$CH_2C(O)CH_3$	257.9±10.5
Br–$CH_2C(O)C_6H_5$	271
Br–$CH_2C(O)OH$	257.4±3.7
Br–$C(NO_2)_3$	218.4
I–CN	320.1
I–CF_3	227.2±1.3
I–CCl_3	168±42

Bond	D^o_{298}/ kJ mol^{-1}
I–CH_2Cl	221.8±4.2
I–CH_2Br	219.2±5.4
I–CH_2I	216.9±7.9
I–CH_3	238.9±2.1
I–CH_2CN	187.0±6.3
I–CF_2CF_3	219.2±2.1
I–CF_2CF_2I	217.6±6.7
I–CH_2CF_3	235.6±4.2
I–$CHFCClF_2$	202±2
I–CF_2CH_3	217.6±4.2
I-CFICH3	218.0±4.2
CF_3CF**I**CF_3	215.1
I–$CH=CH_2$	259.0±4.2
I–C_2H_5	233.5±6.3
I–$CH_2CH=CH_2$	185.8±6.3
I–C_3H_7	236.8±4.2
I–*iso*-C_3H_7	234.7±6.3
I–C_4F_9	205.8
I–*tert*-C_4H_9	227.2±6.3
I–C_6H_5	272.0±4.2
I–C_6F_5	<301.7
I–$CH_2C_6H_5$	187.8±4.8
I–1-naphthyl	274.5±10.5
I–2-naphthyl	272.0±10.5
I–CH_2CN	187.0±8.4
I–CH_2OCH_3	229.4±8.4
I–CH_2SCH_3	216.8±6.3
I–$C(O)CH_3$	223.0±8.4
I–$C(O)C_6H_5$	212.1±8.4
I–$CH_2C(O)OH$	197.5±2.7
I–$C(NO_2)_3$	144.8
(4) O–X BDEs	
HO–**H**	497.10±0.29
FO–**H**	425.1
ClO–**H**	393.7
BrO–**H**	405
IO–**H**	403.3
CH_3O–**H**	440.2±3
CF_3O–**H**	497.1
HC≡CO–**H**	443.1
C_2H_5O–**H**	441.0±5.9
CH_2=CHO–**H**	355.6
CF_3CH_2O–**H**	447.7±10.5
C_3H_7O–**H**	≤433±2
iso-C_3H_7O–**H**	442.3±2.8
C_4H_9O–**H**	432.3
sec-C_4H_9O–**H**	441.4±4.2
tert-C_4H_9O–**H**	444.9±2.8
tert-$BuCH_2O$–**H**	436.1

Bond	D^o_{298}/ kJ mol^{-1}
$C_6H_5CH_2O$–**H**	442.7±8.8
$CH_3C(OH)O$–**H**	446.9±6.3
$(CH_3)_2C(OH)O$–**H**	450.6±6.3
HC(O)O–**H**	468.6±12.6
$CH_3C(O)O$–**H**	468.6±12.6
$C_2H_5C(O)O$–**H**	472.8
iso-$C_3H_7C(O)O$–**H**	472.8
$C_6H_5C(O)O$–**H**	464.4±16.7
HOO–**H**	367.4±2.1
CH_3OO–**H**	370.3±2.1
CF_3OO–**H**	383
CH_2FOO–**H**	379
CCl_3OO–**H**	386
$CHCl_2OO$–**H**	383
CH_2ClOO–**H**	379
CBr_3OO–**H**	383
CH_2BrOO–**H**	379
C_2H_5OO–**H**	354.8±9.2
$CH_3CHClOO$–**H**	377
CH_3CCl_2OO–**H**	383
$CF_3CHClOO$–**H**	384
C_2Cl_5OO–**H**	383
iso-C_3H_7OO–**H**	356
CH_2=$CHCH_2OO$–**H**	372.4
tert-C_4H_9OO–**H**	352.3±8.8
C_6H_5OO–**H**	384
$C_6H_5CH_2OO$–**H**	363
$(C_6H_5)_2CHOO$–**H**	370
$CH_3C(O)OO$–**H**	386
$CCl_2(CN)OO$–**H**	384
$OHCH_2OO$–**H**	368
H–ONO	330.7
H–OONO	299.2
H–ONO_2	426.8
H–ONNOH	189
H–OPO_2	465.7±12.6
H–OSO_2OH	441.4±14.6
H–OSiMe3	495
(CH_3)CHNO-**H**	354.4
$(CH_3)_2$CNO-**H**	354.0
(C_6H_5)CHNO-**H**	368.6
PhO–**H**	362.8±2.9
α-tocopherol RO-**H**	323.4
β-tocopherol RO-**H**	335.6
γ-tocopherol RO-**H**	335.1
δ-tocopherol RO-**H**	342.8
p-$C_6H_5CH_2$-C_6H_4O-**H**	356.2
O–O_2	106.6
HO–OH	210.66±0.42
HO–OF	199.7±8.4

Bond	D^o_{298}/ kJ mol^{-1}
HO–OCl	~146
HO–OBr	138.5±8.4
FO–OF	199.6
ClO–OCl	72.4±2.8
IO–OI	74.9±17
***trans-perp*-HO**–ONO	≤67.8±0.4
***cis-cis*-HO**–ONO	83.3±2.1
HO–ONO_2	163.2±8.4
HO–OCH_3	189.1±4.2
HO–OCF_3	201.3±20.9
HO–OC_2H_5	178.7±6.3
HO–O-*iso*-C_3H_7	185.8±6.3
HO–O-*tert*-C_4H_9	186.2±4.2
HO–$OC(O)CH_3$	169.9±2.1
HO–$OC(O)C_2H_5$	169.9±2.1
$\mathbf{CH_3O}$–OCH_3	167.4±6.3
$\mathbf{CF_3O}$–OCF_3	198.7±2.1
$\mathbf{C_2H_5O}$–OC_2H_5	166.1
$\mathbf{C_3H_7O}$–OC_3H_7	155.2±4.2
***iso*-$\mathbf{C_3H_7O}$**–O-*iso*-C_3H_7	157.7
***sec*-$\mathbf{C_4H_9O}$**–O-*sec*-C_4H_9	152.3±4.2
***tert*-BuO**–O-*tert*-Bu	162.8±2.1
***tert*-$\mathbf{BuCH_2O}$**–OCH_2-*tert*-Bu	152.3
$\mathbf{EtC(Me)_2O}$–$OC(Me)_2Et$	164.4±4.2
$\mathbf{(CF_3)_3CO}$–$OC(CF_3)_3$	148.5±4.6
$\mathbf{Ph_3CO}$–$OCPh_3$	131.4
$\mathbf{SF_5O}$–OSF_5	155.6
$\mathbf{SF_5O}$–$OOSF_5$	126.8
$\mathbf{(CH_3)_3CO}$–$OSi(CH_3)_3$	196.6
***tert*-BuO**–$OGeEt_3$	192.5
***tert*-BuO**–$OSnEt_3$	192.5
$\mathbf{CF_3OO}$–OCF_3	126.8±8.4
HC(O)O–**OH**	199.2±8.4
FC(O)O–OC(O)F	96.2
$\mathbf{CH_3C(O)O}$–ONO_2	131.4±8.4
$\mathbf{CH_3C(O)O}$–$OC(O)CH_3$	140.2±21
$\mathbf{CF_3C(O)O}$–$OC(O)CF_3$	125.5
$\mathbf{CF_3OC(O)O}$–OC(O)F	121.3±4.2
$\mathbf{CF_3OC(O)O}$–OCF_3	142.3±2.9
$\mathbf{CF_3OC(O)O}$–$OC(O)OCF_3$	119.2
$\mathbf{C_2H_5C(O)O}$–$OC(O)C_2H_5$	150.6
$\mathbf{C_3H_7C(O)O}$–$OC(O)C_3H_7$	150.6
$\mathbf{FS(O)_2O}$-$OS(O)_2F$	92–100
HO–CF_3	≤482.0±1.3
FO–CF_3	408±17
HO–CH_3	384.93±0.71
HO–C_2H_5	391.2±2.9
HO–CH_2CF_3	408.4±8.4
HO–$CH_2CH=CH_2$	332.6±4.2

Bond	D^o_{298}/ kJ mol^{-1}
HO–C_3H_7	392.0±2.9
HO–*iso*-C_3H_7	397.9±4.2
HO–C_4H_9	389.9±4.2
HO–*sec*-C_4H_9	396.1±4.2
HO–*iso*-C_4H_9	394.1±4.2
HO–*tert*-C_4H_9	398.3±4.2
HO–$CH(CH_3)(nC_3H_7)$	398.3±4.2
HO–$CH(C_2H_5)_2$	399.2±4.2
HO–$C(CH_3)_2(C_2H_5)$	395.8±6.3
HO–C_6H_5	463.6±4.2
HO–C_6F_5	446.9±9.2
HO–$CH_2C_6H_5$	334.1±2.6
HO–$C(CH_3)_2C_6H_5$	339.3±6.3
cyclo-C_5H_9–**OH**	385.8±6.3
1-$C_{10}H_7$–**OH**	468.6±6.3
2-$C_{10}H_7$–**OH**	467.8±6.3
$(CH_3)_2(NH_2)C$–**OH**	310.4±6.3
$CH_3C(O)$-**OH**	459.4±4.2
$HOCH_2$-**OH**	411.3
CH$_3$–OCH_3	351.9±4.2
ICH$_2$–OCH_3	373.2±12.6
CH_3O–**C$_2$H$_5$**	355.2±5.4
CH_3O–**CHClCH$_3$**	370.3±8.4
CH_3O–**C$_3$H$_7$**	358.6±6.3
CH_3O–***iso*-C$_3$H$_7$**	360.7±4.2
CH_3O-**C$_4$H$_9$**	346.0±6.3
CH_3O-***tert*-C$_4$H$_9$**	353.1±6.3
C$_6$H$_5$–OCH_3	418.8±5.9
C$_6$H$_5$CH(CH$_3$)–OCH_3	313.4±9.6
C$_6$H$_5$–OC_6H_5	326.8±4.2
CH$_3$–OC(O)H	383.7±12.6
HC(O)–OH	457.7±2.1
CH$_3$C(O)–OH	459.4±4.2
C$_6$H$_5$C(O)–OH	447.7±10.5
HO–$CH_2C(O)OH$	368.2±10.5
CH$_3$-$OC(O)CH_3$	380.3±12.6
HC(O)–OCH_3	423.8±4.2
CH$_3$C(O)–OCH_3	424.3±6.3
C$_6$H$_5$C(O)–OCH_3	421.3±12.6
C$_6$H$_5$C(O)–OC_6H_5	307.5±8.4
CH$_3$OCH$_2$–OCH_3	367.5±8.4
CH$_3$C(O)–$OC(O)CH_3$	382.4±12.6
C$_6$H$_5$C(O)–$OC(O)C_6H_5$	384.9±16.7
CH$_3$–OOH	300.4±12.6
C$_2$H$_5$–OOH	332.2±20.9
C$_3$H$_7$–OOH	364.4
***iso*-C$_3$H$_7$**–OOH	298.3
***tert*-C$_4$H$_9$**–OOH	309.2±4.2
CH$_3$–$OOCH_3$	292.5±8.4

Bond	D^o_{298}/ kJ mol^{-1}
CF$_3$–$OOCF_3$	361.5±8.4
CH_3–**OO**	137.0±3.8
CF_3–**OO**	169.0
$CClF_2$–**OO**	127.6
CCl_2F-**OO**	124.7
CH_2Cl–**OO**	122.4±10.5
$CHCl_2$–**OO**	108.2±8.2
CCl_3–**OO**	92.0±6.4
HC(O)–**OOH**	290.0
CH$_3$C(O)–$OOC(O)CH_3$	315.1
ClO–CF_3	≤369.9±1.3
CH_3–**ONO**	245.2
C_2H_5–**ONO**	260.2
C_3H_7–**ONO**	249.4±6.3
iso-C_3H_7–**ONO**	254.4±6.3
C_4H_9–**ONO**	256.5±6.3
iso-C_4H_9–**ONO**	254.0±6.3
sec-C_4H_9–**ONO**	253.6±6.3
tert-C_4H_9–**ONO**	252.7±6.3
$(C_2H_5)(CH_3)_2C$–**ONO**	254.0±8.4
CH_3–**ONO$_2$**	340.2
C_2H_5–**ONO$_2$**	344.8
CH$_3$O–CH_2CN	393.3
O–**N$_2$**	167.4±0.4
O–**NO**	306.24±0.41
O–**NO$_2$**	208.6±1.4
NO–**NO**	40.6±2.1
O_2N–**ONO$_2$**	95.4±1.5
cis-HO–**NO**	207.0
trans-HO-**NO**	200.64±0.19
FO–**NO**	132.5±17
cis-ClO–**NO**	127.6±8.4
trans-ClO–**NO**	116.6±8.4
cis-BrO–**NO**	138.1±8.4
trans-BrO–**NO**	121.6±8.4
trans-perp-HOO–**NO**	114.2±4
CH_3O–**NO**	176.6±3.3
C_2H_5O–**NO**	185.4±4.2
C_3H_7O–**NO**	179.1±6.3
iso-C_3H_7O–**NO**	175.3±4.2
C_4H_9O–**NO**	177.8±6.5
iso-C_4H_9O–**NO**	175.7±6.5
sec-C_4H_9O–**NO**	173.6±3.3
tert-C_4H_9O–**NO**	176.1±5.9
tert-AmO–**NO**	171.1±0.4
C_6H_5O–**NO**	87.0
HO–**NO$_2$**	205.4
FO–**NO$_2$**	131.8±12.6
ClO–**NO$_2$**	111.8±2.1

Bond	D^o_{298}/ kJ mol^{-1}
BrO–**NO$_2$**	118.0±6.3
CH_3O–**NO$_2$**	176.1±4.2
C_2H_5O–**NO$_2$**	174.5±4.2
C_3H_7O–**NO$_2$**	177.0±4.2
iso-C_3H_7O–**NO$_2$**	175.7±4.2
HOO–**NO$_2$**	99.2±4.6
CH_3OO–**NO$_2$**	86.6±8.4
CF_3OO–**NO$_2$**	105
CF_2ClOO–**NO$_2$**	106.7
$CFCl_2OO$–**NO$_2$**	106.7
CCl_3OO–**NO$_2$**	95.8
$CH_3N(O)$-**O**	305.3±4.4
$C_6H_5N(O)$-**O**	392±8
C_5H_5N-**O**	264.9±2.0
$C_6H_5N{=}N(O)(C_6H_5)$-**O**	309.4±3.5
$C_6H_5(O)N{=}N(O)(C_6H_5)$-**O**	309.4±3.6
O–SO	551.1
O–SOF_2	513.3
O–$SOCl_2$	398.5
O–$S(OH)_2$	493.7±25
HO–SH	293.3±16.7
HO–SOH	313.4±12.6
HO–$S(OH)O_2$	384.9±8.4
HO–SCH_3	303.8±12.6
HO–SO_2CH_3	360.2±12.6
F–OH	215.1
F–OF	164.1
F–OCF_3	200.8±4.2
F–OCH_3	>196.6
F–ONO_2	140.6
Cl–OH	233.5
Cl–OCl	142
Cl–OCF_3	≤220.9±8.4
Cl–OCH_3	200.8
Cl–O-*tert*-C_4H_9	198.3
Cl–OOCl	91.2
Cl–ONO_2	169.5
Br–OH	209.6±4.2
Br–OBr	125
Br–O-*tert*-C_4H_9	183.3
Br–ONO_2	143.1±6.3
I–OH	213.4
I–OI	130.1
I-ONO_2	>140.6
(5) N–X BDEs	
H–NH_2	450.08±0.24
H–NF_2	316.7±10.5
H–NNH	254.4
H–N_3	≤389

Bond	D^o_{298}/ kJ mol^{-1}
H–N=CH_2	364±25
H–NO	199.5
H–NCO	460.7±2.1
H–NCS	≤396.6±4.6
H–NCS	347.3±8.4
CH_3N**H**$_2$	425.1±8.4
tert-BuN**H**$_2$	397.5±8.4
$C_6H_5CH_2N$**H**$_2$	418.4
$(CH_3)_2N$**H**	395.8±8.4
H–NHNH(CH_3)	276±21
H–NHN(CH_3)$_2$	356±21
N**H**$_2$CN	414.2
(N**H**$_2$)$_2$C=O	464.4
(N**H**$_2$)$_2$C=S	389.1
CH_3CSN**H**$_2$	380.7
PhCSN**H**$_2$	380.7
(PhN**H**)$_2$C=S	364.0
(N**H**$_2$)$_2$C=NH	435.1
Ph_2C=N**H**	489.5
H–N($SiMe_3$)$_2$	464
H–NHPh	375.3
C_6H_5N**H**OH	292
C_6H_5N**H**(CONMe2)	387.9
H–NPh_2	364.8
HN–N_2	63
ON–N	480.7±0.4
ON–NO	8.49±0.12
ON–NO_2	42.5
O$_2$N–NO_2	57.3±1
H$_2$N–NH_2	277.0±1.3
F$_2$N–NF_2	92.9±12.6
H$_2$N–$NHCH_3$	275.8±8.4
H$_2$N–N(CH_3)$_2$	259.8±8.4
H$_2$N–NHC_6H_5	227.6±8.4
H$_2$N–NO_2	230
$H_2NN(CH_3)$–**NO**	179.6
$(C_6H_5)_2N$-**NO**	94.6
N$_3$–CH_3	335.1±20.5
N$_3$–C_6H_5	375.7±20.9
N$_3$–$CH_2C_6H_5$	211.3±14.2
CH_3–**NC**	413.0±3.3
C_2H_5–**NC**	413.4±8.4
iso-C_3H_7–**NC**	423.0±8.4
tert-C_4H_9–**NC**	399.6±5.4
NC–**NO**	204.4
CH_3–**NO**	172
CF_3–**NO**	167
CCl_3–**NO**	125
C_2H_5–**NO**	171.5

Bond	D^o_{298}/ kJ mol^{-1}
CH_2CHCH_2–**NO**	110
iso-C_3H_7–**NO**	152.7±12.6
tert-C_4H_9–**NO**	167
C_6H_5–**NO**	226.8±2.1
C_6F_5–**NO**	211.3±4.2
$C_6H_5CH_2$–**NO**	123
CH_3–**NO$_2$**	260.7±2.1
C_2H_5–**NO$_2$**	254.4
C_3H_7–**NO$_2$**	256.5
iso-C_3H_7–**NO$_2$**	259.8
C_4H_9–**NO$_2$**	254.8
sec-C_4H_9–**NO$_2$**	263.2
tert-C_4H_9–**NO$_2$**	258.6
C_6H_5–**NO$_2$**	295.8±4.2
$C_6H_5CH_2$–**NO$_2$**	210.3±6.3
$(NO_2)CH_2$–**NO$_2$**	207.1
$(NO_2)_3C$–**NO$_2$**	176.1
CF_3–**NF$_2$**	280.7
$C_6H_5CH_2$–**NF$_2$**	237.2±14.6
CH_3–**NH$_2$**	356.1±2.1
C_2H_5–**NH$_2$**	352.3±6.3
C_3H_7–**NH$_2$**	356.1±2.9
iso-C_3H_7–**NH$_2$**	357.7±3.8
C_4H_9–**NH$_2$**	356.1±2.9
sec-C_4H_9–**NH$_2$**	359.0±2.9
iso-C_4H_9–**NH$_2$**	254.8±5.0
tert-C_4H_9–**NH$_2$**	355.6±6.3
pyridin-2-yl–**NH$_2$**	431
C_6H_5–**NH$_2$**	429.3±4.2
$C_6H_5CH_2$–**NH$_2$**	306.7±6.3
$C_6H_5CH(CH)_3$–**NH$_2$**	307.5±9.6
HC(O)–**NH$_2$**	421.7±8.4
CH_3C(O)–**NH$_2$**	414.6±8.4
HS–**NO**	138.9
CH_3S–**NO**	104.6±4.2
tert-BuS–**NO**	115.1
$PhCH_2S$–**NO**	120.5
C_6H_5S-**NO**	81.2±5.4
SCN–SCN	255.6
FSO$_2$–NF_2	163
F–NO	235.26
F–NO_2	221.3
F–NF_2	254.0
F–NH_2	286.6
Cl–NO	158.8±0.8
Cl–NO_2	141.8±1.3
Cl–NF_2	~134
Cl–NH_2	253.1
Br–NO	120.1±0.8

Bond	D^o_{298}/ kJ mol^{-1}
Br–NO_2	82.0±7.1
Br–NF_2	<227.2
I–NO	75.6±4
I–NO_2	79.6±4
(6) S–X BDEs	
H–SH	381.18±0.05
H–SCH_3	365.7±2.1
H–$SCHCH_2$	351.5±8.4
H–SC_2H_5	365.3
H–SC_3H_7	365.7
H–S-*iso*-C_3H_7	369.9±8.4
H–S-*tert*-C_4H_9	362.3±9.2
H–SOH	330.5±14.6
H–$SCOCH_3$	370.7
H–SCOPh	364
H–SO_2CH_3	≤397
H–$SSCH_3$	330.5±14.6
H–SPh	349.4±4.5
H–SSH	318.0±14.6
H–SSSH	292.9±6.5
HS–SH	270.7±8.4
FS–SF	362.3
ClS–SCl	329.7
HS–SCH_3	272.0
HS–SPh	255.2±6.3
CH$_3$S–SCH_3	272.8±3.8
C$_2$H$_5$S–SC_2H_5	276.6
MeS–SPh	272.0±6.3
C$_6$H$_5$S–SC_6H_5	214.2±12.6
F$_5$S–SF_5	305±21
HS–CH_3	312.5±4.2
HS–C_2H_5	307.9±2.1
HS–C_3H_7	310.5±2.9
HS–*iso*-C_3H_7	307.1±3.8
HS–C_4H_9	309.2±2.9
HS–*sec*-C_4H_9	307.5±2.9
HS–*iso*-C_4H_9	310.0±4.6
HS–*tert*-C_4H_9	301.2±3.8
HS–C_6H_5	360.7±6.3
HS–$CH_2C_6H_5$	258.2±6.3
HS–C(O)H	309.6±8.4
HS–C(O)CH_3	307.9±6.3
CH_3S–**CH$_3$**	307.9±3.3
HOS–**CH$_3$**	284.9±12.6
CH_3SO–**CH$_3$**	221.8±8.4
$HOSO_2$–**CH$_3$**	324.3±12.6
CH_3SO_2–**CH$_3$**	279.5
F$_5$S–CF_3	392±43
F–SF_5	391.6

Bond	D^o_{298}/ kJ mol^{-1}
F–SO_2(F)	379
Cl–SF_5	<272
Cl–SO_2CH_3	293
Cl-SO_2Ph	297
Br-SBr	259±17
Br–SF_5	<230
I-SH	206.7±8.4
I-SCH_3	206.3±7.1
(7) Si-, Ge-, Sn-, and Pb–X BDEs	
SiH_3–**H**	383.7±2.1
Me_3Si–**H**	396±7
H_5Si_2–**H**	373±8
$(C_2H_5)_3Si$–**H**	396±4
$C_6H_5SiH_2$–**H**	382±5
$(CH_3S)_3Si$–**H**	364.0
$(iPrS)_3Si$–**H**	376.6
$PhMe_2Si$–**H**	377±7
Ph_2SiH–**H**	379±7
Ph_2MeSi–**H**	361±10
SiF_3–**H**	432±5
$SiCl_3$–**H**	395±5
$SiBr_3$–**H**	334±8
SiH_3–**SiH_3**	321±4
SiH_3–Si_2H_5	313±8
Ph_3Si–$SiPh_3$	368.2
F_3Si–SiF_3	453.1±25
SiH_3–**CH_3**	375±5
SiF_3–**CH_3**	355.6
H_3Si–**NO**	158.2±5.7
H_3Si–**PH_2**	331.4
SiH_3–**F**	638±5
SiH_3–**Cl**	458±7
SiH_3–**Br**	376±9
SiH_3–**I**	299±8
GeH_3–**H**	348.9±8.4
Me_3Ge–**H**	364.0
Ph_3Ge–**H**	359.8
$(CH_3)_3Ge$-$Ge(CH_3)_3$	280.3
$(CH_3)_3Ge$-CH_3	288.7
Me_3Sn–**H**	326.4
Ph_3Sn–**H**	294.6
$(CH_3)_3Sn$-$Sn(CH_3)_3$	257.7
$(CH_3)_3Sn$-Cl	425±17
$(CH_3)_3Pb$-$Pb(CH_3)_3$	228.4
Cl_3Pb-Cl	271±84
$(CH_3)_3Pb$-CH_3	238±21
(8) P-, As-, Sb-, Bi–X BDEs	
H_2P–**H**	351.0±2.1
CH_3PH–**H**	322.2±12.6
H_2P–PH_2	256.1
$(C_2H_5)_2P$–$P(C_2H_5)_2$	359.8
F_2P–F	549
Cl_2P–Cl	356±8
Br_2P–Br	<259
I_2P–I	217
H_2P–SiH_3	331.4
H_2As–H	319.2±0.8
H_2Sb-H	288.3±2.1
F_2Bi–F	435±19
Br_2Bi–Br	>297.1
(9) Se- and Te–X BDEs	
H–SeH	334.93±0.75
H–SeC_6H_5	326.4±16.7
PhSe–SePh	280±19
H–TeH	277.0±5.0
H–TeC_6H_5	≤264
PhTe–TePh	138.1±12.6
(10) Metal-Centered BDEs	
Arranged by the Periodic Table	
(10.1) Group 1	
Li–OH	431.0
Li–C_2H_5	214.6±8.4
Li–nC_4H_9	197.9±16.3
Na–OH	342.3
Na–O_2	<200
K–OH	359
Rb–OH	356.2±4.2
Cs–OH	373
(10.2) Group 2	
BeO–H	469
Be(OH)–OH	476
MgO–H	441
Mg(OH)–OH	349
BrMg–CH_3	253
BrMg–CH_2CH_3	205
BrMg–i-C_3H_7	184
BrMg–t-C_4H_9	174
BrMg–C_6H_5	289
BrMg–$CH_2C_6H_5$	201
BrMg–$C(C_6H_5)_3$	180
Ca(OH)–OH	409
Sr(OH)–OH	407
Ba(OH)–OH	443
(10.3) Group 3	
Sc–CH_3	116±29
Sc–C_6H_6	60.8
La(η^5-**C_5Me_5**)$_2$–$CH(SiMe_3)_2$	278.7±10.5
Nd(η^5-**C_5Me_5**)$_2$–$CH(SiMe_3)_2$	236.8±10.5
(η^5-**C_5Me_5**)$_2$**Sm**–H	226.8±12.6
(η^5-**C_5Me_5**)$_2$**Sm**–OCH_3	343.1
(η^5-**C_5Me_5**)$_2$**Sm**–(η^3-C_3H_5)	188.3±6.3
(η^5-**C_5Me_5**)$_2$**Sm**–S-nC_3H_7	295.4±10.0
(η^5-**C_5Me_5**)$_2$**Sm**–$N(CH_3)_2$	201.7±7.5
(η^5-**C_5Me_5**)$_2$**Sm**–$SiH(SiMe_3)_2$	179.9±21
(η^5-**C_5Me_5**)$_2$**Sm**–$P(Et)_2$	136.4±8.4
(η^5-**C_5Me_5**)$_2$**Eu**–I	238.9±8.4
(η^5-**C_5Me_5**)$_2$**Yb**–I	256.1±6.3
Lu(η^5-**C_5Me_5**)$_2$–$CH(SiMe_3)_2$	279.1±10.5
(η^5-**$C_5H_4SiMe_3$**)$_3$**Th**–H	277±6
(η^5-**$C_5H_4SiMe_3$**)$_3$**Th**–O	371±24
(η^5-**C_5H_5**)$_3$**Th**–CH_3	375±9
(η^5-**C_5H_5**)$_3$**Th**–$CH_2Si(CH_3)_3$	369±12
(**C_9H_7**)$_3$**Th**–$CH_2C_6H_5$	342±9
(η^5-**C_5H_4tBu**)$_3$U–H	249.7±5.7
(η^5-**$C_5H_4SiMe_3$**)$_3$**U**–H	253.7±5.1
[HB(3,5-Me_2Pz)$_3$]U(Cl)$_2$–Cl	422.6
(η^5-**$C_5H_4SiMe_3$**)$_3$**U**–I	265.6±4.3
(η^5-**C_5H_4tBu**)$_3$**U**–O	307±9
(η^5-**$C_5H_4SiMe_3$**)$_3$**U**–CO	43.1±0.8
(**C_9H_7**)$_3$**U**–CH_3	196.3±6.6
(η^5-**C_5Me_5**)$_2$**U(Cl)**–C_6H_5	358±11
(η^5-**$C_5H_4SiMe_3$**)$_3$**U**–THF	41.0±0.8
(10.4) Group 4	
Ti(η^5-**C_5H_5**)$_2$–Cl	471
Ti(Cl)(η^5-**C_5H_5**)$_2$–Cl	390
Ti(η^5-**C_5Me_5**)$_2$–I	219
Ti(η^5-**C_5H_5**)$_2$–CO	174
Ti(CO)(η^5-**C_5H_5**)$_2$–CO	170
Ti–CH_3	174±29
Ti(Cl)(η^5-**C_5H_5**)$_2$–CH_3	276
Ti(Cl)((η^5-**C_5H_5**)$_2$–C_6H_5	292
Ti(C_6H_6)–C_6H_5	308.7
Zr(η^5-**C_5Me_5**)$_2$–H	351.0±7.5
Zr(H)(η^5-**C_5Me_5**)$_2$–H	326.4±4
Zr(η^5-**C_5Me_5**)$_2$–Cl	481.2
Zr(η^5-**C_5Me_5**)$_2$–Br	410.0
Zr(I)(η^5-**C_5Me_5**)$_2$–I	336.4±2.1
Zr(η^5-**C_5Me_5**)$_2$**(Ph)**–OH	482.4±6.3
Zr(η^5-**C_5Me_5**)$_2$**(Ph)(OH)**–OH	482.8±10.5
Zr(η^5-**C_5Me_5**)$_2$**(NH_2)H**–NH_2	421.3±15.1
Zr(η^5-**C_5Me_5**)$_3$–CH_3	276±10
Zr(η^5-**C_5H_5**)$_2$**(C_6H_5)**–C_6H_5	300±10
Zr(η^5-**C_5H_5**)$_2$**(Si($SiMe_3$)$_3$)**–$SiMe_3$	188±30
Hf(H)(η^5-**C_5Me_5**)$_2$–H	346.0±7.9
Hf(η^5-**C_5Me_5**)**(C_4H_9)**–C_4H_9	274±10
(10.5) Group 5	
(η^5-**C_5H_5**)**(CO)**$_3$**V**–η^2H_2	90±20
(η^5-**C_5H_5**)**(CO)**$_3$**V**–CO	146±21

Bond	D^o_{298}/ kJ mol^{-1}
V–CH_3	169±18
V–C_6H_6	76.2
V(C$_6$H$_6$)–C_6H_6	307.8
Nb(η^5-**C$_5$H$_5$)$_2$H$_3$**–TFE	18.8±1.3
Ta(CH$_3$)$_5$–CH_3	261±5
(Me$_3$SiCH$_2$)$_4$Ta–(CH_2SiMe_3)	184.1±8.4
(10.6) Group 6	
[Cr(CO)$_3$(η^5-**C$_5$Me$_5$)]$_2$**–Hg**	61.5
[Cr(CO)$_3$(η^5-**C$_5$Me$_5$)]–Hg**	111.3
Cr(CO)$_5$–Xe	37.7±3.8
(CO)$_2$(PPh$_3$)(η^5-**C$_5$H$_5$)Cr**–H	250.2±4.2
(η^5-**C$_5$H$_5$)Cr(CO)$_3$**–H,	257
Cr(CO)$_5$–H_2	78±4
(P(C$_6$H$_{11}$)$_3$)$_2$(CO)$_3$Cr–H_2	30.5±0.4
(η^6-**C$_6$H$_6$)(CO)$_3$Cr**–H_2	251±17
Cr(CO)$_5$–N_2	81±4
(P(C$_6$H$_{11}$)$_3$)$_2$(CO)$_3$Cr–N_2	38.9±0.8
(η^5-**C$_5$Me$_5$)(CO)$_3$Cr**–SH	193
Cr(CO)$_5$–CO	154.0±8.4
Cr(CO)$_5$–CH_4	~33.5±8
Cr–C_6H_6	9.6±5.8
Cr(C$_6$H$_6$)–C_6H_6	268.2±15.4
Cr(CO)$_5$–C_6H_6	57.3±3.3
(P(C$_6$H$_{11}$)$_3$)$_2$(CO)$_3$Cr–P (OMe$_3$)$_3$	68.6±2.5
(η^5-**C$_5$H$_5$))Mo(CO)$_3$**–H	290
Mo(η^5-**C$_5$H$_5$)$_2$**–H	246
Mo(H)(η^5-**C$_5$H$_5$)$_2$**–H	256.9±8.4
Mo(CO)$_3$(η^5-**C$_5$H$_5$)**–I	216.7±4.2
(η^5-**C$_5$Me$_5$)$_2$Mo**–O	272
(P(C$_6$H$_{11}$)$_3$)$_2$(CO)$_3$Mo–H_2	27.2±0.8
(P(C$_6$H$_{11}$)$_3$)$_2$(CO)$_3$Mo–N_2	37.7±2.5
Mo(CO)$_5$–CO	169.5±8.4
Mo(CO)$_3$ (η^5-**C$_5$H$_5$)**–CH_3	203±8
W(CO)$_5$–Xe	35.1±0.8
W(CO)$_3$(η^5-**C$_5$H$_5$)**–H	303
W(H)(η^5-**C$_5$H$_5$)$_2$**–H	310.9±4.2
W(I)(η^5-**C$_5$H$_5$)$_2$**–H	273±14
(CO)$_5$W–H_2	≥67
(P(C$_6$H$_{11}$)$_3$)(CO)$_3$W–(η^2-H_2)	28.5±2.1
W(CO)$_5$–CO	192.5±8.48.4
W(CH$_3$)(η^5-**C$_5$H$_5$)$_2$**–CH_3	220.9±4
(10.7) Group 7	
F$_3$Mn–MnF_3	210.9±2.5
(CO)$_5$Mn–$Mn(CO)_5$	185±8
(CO)$_5$Mn–H	284.5
(PPh$_3$)Mn(CO)$_4$–H	286.2
MnBr(CO)$_4$–CO	184
(η^5-**C$_5$H$_5$)(CO)$_2$Mn**–CO	195.8±9.2
Mn–CH_3	>35±12
Mn(CO)$_5$–CH_3	187.0±3.8

Bond	D^o_{298}/ kJ mol^{-1}
Mn(CO)$_5$–C_6H_5	207±11
(CO)$_5$Mn–$Re(CO)_5$	149±11
(η^5-**C$_5$H$_5$)Mn(CO)$_2$**–PhMe	59.4±3.3
(CO)$_5$Tc–$Tc(CO)_5$	177.5±1.9
(CO)$_5$Re–$Re(CO)_5$	187±4.8
(CO)$_5$Re–H	313
(CO)$_5$Re–CH_3	220±8
(10.8) Group 8	
(CO)$_4$Fe–$Fe(CO)_5$	171.5
(CO)$_4$Fe(H)$_x$–H	259.4±8.4
(η^5-**C$_5$H$_5$)(CO)$_2$Fe**–H	239
Fe(CO)$_3$(N$_2$)–N_2	37.7±19.2
Fe(C$_2$H$_2$)(CO)$_4$–CO	88±2.3
Fe(CO)$_2$(PMe$_3$)–CO	>125
Fe(CO)$_3$(PPh$_3$)–CO	<177.8±5
Fe–NH_3	31.4±4.2
Fe–CH_2	364±29
Fe–CH_3	135±29
Fe(C$_2$H$_4$)(CO)$_3$–C_2H_4	89.1±8
Fe–C_3H_5	218
Fe–C_3H_6	79
Fe(CO)$_5$–$Ni(CO)_4$	37.7
Fe(CO)$_5$–(η^3-C_3H_5)	176
Fe(C$_3$H$_6$)(CO)$_3$–C_3H_6	~79.5
(CO$_2$)(η^5-**C$_5$H$_5$)Ru**–H	272
(PMe$_3$)$_2$(η^5-**C$_5$Me$_5$)Ru**–H	167.4
(CO)$_2$(η^5-**C$_5$Me$_5$)Ru**–Cl	337.6
(η^5-**C$_5$Me$_5$)(PMe$_3$)$_2$Ru**–Cl	<138
(η^5-**C$_5$Me$_5$)(PMe$_3$)$_2$Ru**–OH	204.6
(CO)$_4$Ru–CO	115±1.7
(η^5-**C$_5$Me$_5$)(PMe$_3$)$_2$Ru**–CH_3	142.3
Os(H)(CO)$_4$–H	326.4
(CO)$_4$Os–CO	133±2.6
Os(C$_2$H$_2$)(CO)$_4$–CO	99.5±0.8
(10.9) Group 9	
(CO)$_4$Co–$Co(CO)_4$	83±29
(CO)$_4$Co–$Mn(CO)_5$	96±12
(CO)$_4$Co–$Re(CO)_5$	113±15
Co(CO)$_4$–H	278
Co(CO$_3$)(PPh$_3$)–H	272
(CO)$_3$HCo–CO	~54
(η^5-**C$_5$H$_5$)Co(CO)**–CO	184.3±4.8
Co–CH_2	331±38
Co–CH_3	178±8
cobalamin–CH_3	150.6
cobinamide–iC_4H_9	104
Co–C bonds in B_{12}	123.8±6.3
Cl(CO)$_2$Rh–$Rh(CO)_2Cl$	94.6
HRh(m-xylyl)Rh–H	255.6±1.7
(PiPr$_3$)$_2$(Cl)Rh–H_2	136.0
(PiPr$_3$)$_2$(Cl)Rh–N_2	69.0

Bond	D^o_{298}/ kJ mol^{-1}
(PiPr$_3$)$_2$(Cl)Rh–CO	201.7
HRh(m-xylyl)Rh–CH_2OH	195.4±7.5
Ir(Cl)(CO)(PMe$_3$)$_2$–H	251
Ir(H)(η^5-**C$_5$Me$_5$)(PMe$_3$)**–H	310.5±21
Ir(Cl)(H)(CO)(PEt$_3$)$_2$–H	243.1
Ir(Cl)(H)(CO)(PPh$_3$)$_2$–H	246.9
(Cl)(CO)(PPh$_3$)$_2$Ir–H_2	62.8
(Cl)(CO)(PPh$_3$)$_2$Ir–CO	45.2
Ir(H)(η^5-**C$_5$Me$_5$)(PMe$_3$)**–C_6H_5	321
(10.10) Group 10	
Ni–H_2O	~29
Ni(CO)$_3$–N_2	~42
Ni(CO)$_3$–CO	104.6±8.4
Ni–CH_3	208±8
Ni–C_2H_2	193±25
Ni–C_2H_4	147.3±17.6
Ni–propyne	155±21
Ni–2-butyne	121±21
Pd–OH	213
***trans*-Pt(PPh$_3$)$_2$(Cl)**–H	307±37
[Ph$_2$PCH$_2$]$_2$MePt–H	104.6
[Ph$_2$PCH$_2$]$_2$MePt –OH	167.4
[Ph$_2$PCH$_2$]$_2$MePt –SH	90.0
Pt(η^5-**C$_5$H$_5$)(CH$_3$)$_2$**–CH_3	163±21
***cis*-Pt(PEt$_3$)$_2$(CH$_3$)**–CH_3	269±13
(10.11) Group 11	
Cu–OH	>406
Cu–CO	25±5
Cu–CH_3	223±5
Cu–NH_3	47±15
Cu(NH$_3$)–NH_3	83.7±4.2
Cu–C_6H_6	16.4±12.5
Cu(C$_6$H$_6$)–C_6H_6	27.0±19.3
Ag–CH_3	134.1±6.8
Ag–NH_3	8±13
Ag(NH$_3$)–NH_3	62.8±4.2
Au–OH	>262
Au–NH_3	76±6
Au–CH_3	≥191.6
Au–C_6H_6	8.4
(10.12) Group 12	
Zn–CH_3	70±10
Zn(CH$_3$)–CH_3	266.5±6.3
Zn–C_2H_5	92.0±17.6
Zn(C$_2$H$_5$)–C_2H_5	219.2±8.4
Cd–CH_3	63.6±10.0
Cd(CH$_3$)–CH_3	234.3±6.3
Hg–CH_3	22.6±12.6
Hg(CH$_3$)–CH_3	239.3±6.3
ClHg–CH_3	280.0±12.6

Bond	D^o_{298}/ kJ mol^{-1}
BrHg–CH_3	270±38
IHg–CH_3	258.6±12.6
(10.13) Group 13	
$\mathbf{H_3B}$–BH_3	172
$\mathbf{H_3B}$–NH_3	130.1±4.2
$\mathbf{(CH_3)_3B}$–NH_3	57.7±1.3
$\mathbf{F_3B}$–$N(CH_3)_3$	130±4.6
$\mathbf{Cl_3B}$–$N(CH_3)_3$	127.6
$\mathbf{F_2B}$–CH_3	397 - 418
Al–OH	547±13
Al–C_2H_2	>54
$\mathbf{Cl_3Al–N(CH_3)_3}$	198.7±8.4
$\mathbf{(CH_3)_3Al}$–$N(CH_3)_3$	130
$\mathbf{(CH_3)_3Al}$–$O(CH_3)_2$	92
$\mathbf{(CH_3)_3Ga}$–$O(C_2H_5)_2$	50.6±0.8
$\mathbf{Cl_3Ga}$-$S(C_2H_5)_2$	235.1
In–CH_3	216.3
$\mathbf{In(CH_3)_1}$–CH_3	318.8
$\mathbf{In(CH_3)_2}$–CH_3	587.4
$\mathbf{(CH_3)_3In}$–$N(CH_3)_3$	83.3±2.1
Tl–OH	330±30

TABLE 4. Enthalpies of Formation of Free Radicals and Other Transient Species

Reference

Yu-Ran Luo, *Comprehensive Handbook of Chemical Bond Energies*, Taylor & Francis, 2006.

Radical	$\Delta_f H^o_{298}$/ kJ mol-1
(1) Carbon-Centered Species	
CH	595.8±0.6
CH_2 (triplet)	391.2±1.6
CH_2 (singlet)	428.8±1.6
$^{\bullet}CH_3$, methyl	146.7±0.3
$^{\bullet}C_2H$, acetenyl, $CH{\equiv}C^{\bullet}$	567.4±2.1
$^{\bullet}C_2H_2$, vinylidene $CH_2{=}C^{\bullet\bullet}$	419.7±16.7
$^{\bullet}C_2H_3$, vinyl, $CH_2{=}C^{\bullet}H$	299.6±3.3
$^{\bullet}C_2H_5$, ethyl, $CH_3C^{\bullet}H_2$	118.8±1.3
$^{\bullet}C_3H_3$, propargyl, $CH{\equiv}CC^{\bullet}H_2$	339.0±4.2
$^{\bullet}C_3H_3$, $CH_3C{\equiv}C^{\bullet}$	515±13
$^{\bullet}C_3H_3$, $CH_2{=}C{=}CH^{\bullet} \leftrightarrow CH{\equiv}CC^{\bullet}H_2$	339.0±4.2
$^{\bullet}C_3H_3$, cyclopro-2-en-1-yl	439.7±17.2
$^{\bullet}C_3H_5$, allyl, $CH_2{=}CHC^{\bullet}H_2$	171.0±3.0
$^{\bullet}C_3H_5$, $CH_3CH{=}C^{\bullet}H$	267±6
$^{\bullet}C_3H_5$, $CH_3C^{\bullet}{=}CH_2$	231.4
$^{\bullet}C_3H_5$, cyclopropyl	279.9±10.5
n-$C_3H_7^{\bullet}$, n-propyl, $CH_3CH_2C^{\bullet}H_2$	100±2
i-$C_3H_7^{\bullet}$, i-propyl, $CH_3C^{\bullet}HCH_3$	88±3
$^{\bullet}$n-C_4H_3, $CH{\equiv}CCH{=}C^{\bullet}H$	547.3
$^{\bullet}$i-C_4H_3, $CH_2{=}C^{\bullet}C{\equiv}CH$	499.2
$^{\bullet}C_4H_5$, $CH_3C{\equiv}CC^{\bullet}H_2$	304.5
$^{\bullet}C_4H_5$, $CH{\equiv}CC^{\bullet}HCH_3$	316.5
$^{\bullet}C_4H_5$, $^{\bullet}CH{=}CHCHCH_2$	364.4
$^{\bullet}C_4H_5$, $CH_2{=}CHC^{\bullet}CH_2$	313.3
$^{\bullet}C_4H_7$, $CH_3CH{=}CHC^{\bullet}H_2$	146±8
$^{\bullet}C_4H_7$, $CH_2{=}CHCH_2C^{\bullet}H_2$	192.5
$^{\bullet}C_4H_7$, $CH_2{=}C(CH_3)C^{\bullet}H_2$	137.9
$^{\bullet}C_4H_7$, $CH_2{=}CHC^{\bullet}HCH_3$	136.2
$^{\bullet}C_4H_7$, cyclopropylmethyl	213.8±6.7
$^{\bullet}C_4H_7$, cyclobutyl	219.2±4.2
n-$C_4H_9^{\bullet}$, n-butyl, $CH_3CH_2CH_2C^{\bullet}H_2$	77.8±2.1
i-$C_4H_9^{\bullet}$, i-butyl, $(CH_3)_2CHC^{\bullet}H_2$	70±4
s-$C_4H_9^{\bullet}$, s-butyl, $CH_3C^{\bullet}HCH_2CH_3$	67.8±2.1
t-$C_4H_9^{\bullet}$, t-butyl, $(CH_3)_3C^{\bullet}$	48±3
$^{\bullet}C_5H_3$, $CH{\equiv}C\text{-}C{\equiv}CC^{\bullet}H_2$	579.1
$^{\bullet}C_5H_3$, $(CH{\equiv}C)_2C^{\bullet}H$	573.2
$^{\bullet}C_5H_5$, $CH_2{=}CHC{\equiv}CC^{\bullet}H_2$	351.5
$^{\bullet}C_5H_5$, $CH_2{=}CH\text{-}C^{\bullet}H\text{-}C{\equiv}CH$	372.4
$^{\bullet}C_5H_5$, cyclopenta-1,3-dien-5-yl	261.5±4.2
$^{\bullet}C_5H_7$, $CH_3C{\equiv}CC^{\bullet}HCH_3$	272.8±9.2
$^{\bullet}C_5H_7$, $CH{\equiv}CC^{\bullet}HC_2H_5$	277.0±8.4
$^{\bullet}C_5H_7$, $CH{\equiv}CC^{\bullet}(CH_3)_2$	257.3±9.2
$^{\bullet}C_5H_7$, $CH_2{=}CHCH{=}CHC^{\bullet}H_2$	205.0±12.6
$^{\bullet}C_5H_7$, $(CH_2{=}CH)_2C^{\bullet}H$	208.0±4.2
$^{\bullet}C_5H_7$, $CH_3CH{=}C{=}CHC^{\bullet}H_2$	278.0
$^{\bullet}C_5H_7$, spiropentyl	380.7±4.2
$^{\bullet}C_5H_7$, cyclopent-1-en-3-yl	160.7±4.2
$^{\bullet}C_5H_9$, cyclopentyl	105.9±4.2
$^{\bullet}C_5H_9$, $CH_2{=}CHC^{\bullet}HCH_2CH_3$	109.6±8.4
$^{\bullet}C_5H_9$, $CH_3CH{=}CHC^{\bullet}H(CH_3)$	92
$^{\bullet}C_5H_9$, $CH_3CH{=}C(CH_3)C^{\bullet}H_2$	92.0
$^{\bullet}C_5H_9$, $CH_2{=}CHC^{\bullet}(CH_3)_2$	87.0±8.4
$^{\bullet}C_5H_9$, $CH_2{=}C(CH_3)C^{\bullet}H(CH_3)$	93.7
$^{\bullet}C_5H_9$, $CH_2{=}C(C^{\bullet}H_2)CH_2CH_3$	114.2
$^{\bullet}C_5H_9$, $CH_2{=}CH(CH_2)_2C^{\bullet}H_2$	179.5
$nC_5H_{11}^{\bullet}$, $CH_3CH_2CH_2CH_2C^{\bullet}H_2$	54.4
$^{\bullet}C_5H_{11}$, $(C_2H_5)_2C^{\bullet}H$	47.0
$^{\bullet}C_5H_{11}$, $(nC_3H_7)(CH_3)C^{\bullet}H$	50.2
$^{\bullet}C_5H_{11}$, $(CH_3)_3C^{\bullet}CH_2$	36.4±8.4
$^{\bullet}C_5H_{11}$, $(C_2H_5)(CH_3)_2C^{\bullet}$	29
$^{\bullet}C_6H_5$, phenyl	330.1±3.3
$^{\bullet}C_6H_7$, cyclohexa-1,3-dien-5-yl	199.2
$^{\bullet}C_6H_7$, cyclohexa-1,4-dien-3-yl	201.7±5.0
$^{\bullet}C_6H_9$, $CH_3C{\equiv}CC^{\bullet}(CH_3)_2$	221.8±9.2
$^{\bullet}C_6H_9$, $(CH_2{=}CH)_2C^{\bullet}(CH_3)$	193.7
$^{\bullet}C_6H_9$, cyclohexa-1-en-3-yl	119.7
$^{\bullet}C_6H_{11}$, $CH_2{=}CH(CH_2)_3C^{\bullet}H_2$	158.6
$^{\bullet}C_6H_{11}$, $CH_2{=}CHC^{\bullet}H(CH_2)_2CH_3$	89.0
$^{\bullet}C_6H_{11}$, $CH_2{=}C(CH_3)C^{\bullet}(CH_3)_2$	37.7±6.3
$^{\bullet}C_6H_{11}$, $(CH_3)_2C{=}C(CH_3)C^{\bullet}H_2$	39.7±6.3
$^{\bullet}C_6H_{11}$, $(CH_3)_2C{=}CHC^{\bullet}H(CH_3)$	47.3
$^{\bullet}C_6H_{11}$, (Z)-$CH_3CH{=}CHC^{\bullet}(CH_3)_2$	54.4
$^{\bullet}C_6H_{11}$, cyclohexyl	75.3±6.3
$nC_6H_{13}^{\bullet}$, $CH_3CH_2CH_2CH_2CH_2C^{\bullet}H_2$	33.5
$^{\bullet}C_6H_{13}$, $(nC_4H_9)(CH_3)C^{\bullet}H$	29.3
$^{\bullet}C_6H_{13}$, 2-methyl-2-pentyl	3.3±8.4
$^{\bullet}C_6H_{13}$, 3-methyl-3-pentyl	14.2
$^{\bullet}C_6H_{13}$, 2,3-dimethyl-2-butyl	3.1±10
$^{\bullet}C_7H_3$, $(CH{\equiv}C)_3C^{\bullet}$	784.5
$^{\bullet}C_7H_7$, benzyl, $C_6H_5C^{\bullet}H_2$	208.0±1.7
$^{\bullet}C_7H_7$, quadricyclolan-5-yl	578.6±5.4
$^{\bullet}C_7H_7$, quadricyclolan-4-yl	587.4±5.4
$^{\bullet}C_7H_7$, norborna-2,5-dien-7-yl	511.7±7.9
$^{\bullet}C_7H_7$, cyclohepta-1,3,5-trien-7-yl	285.3±12.6
$^{\bullet}C_7H_9$, $CH_2{=}CH(CH{=}CH)_2CC^{\bullet}H_2$	251.0
$^{\bullet}C_7H_9$, $(CH_2{=}CH)_3C^{\bullet}$	274.0
$^{\bullet}C_7H_{11}$, norborn-1-yl	136.4±10.5
$^{\bullet}C_7H_{11}$, cycloheptenyl	119.2
$^{\bullet}C_7H_{13}$, cycloheptyl	50.6±4.2

Radical	$\Delta_f H^o_{298}$/ kJ mol-1
•C_7H_{13}, cyclo-[C•$(CH_3)(CH_2)_5$]	22.6
•C_7H_{13}, cyclo-[C•$(CH_2CH_3)(CH_2)_4$]	47.0
•C_7H_{15}, $(nC_5H_{11})(CH_3)$CH•	8.4
•C_7H_{15}, $(CH_3)_2$CHCHC•$(CH_3)_2$	-21.8±5.2
•C_8H_7, cubyl	831.0±16.7
•C_8H_7, C_6H_5C•=CH_2	309.6
•C_8H_7, C_6H_5CH=CH•	387.0
•C_8H_9, C_6H_5C•H(CH_3)	175.7±7.5
•C_8H_9, $C_6H_5CH_2$C•H_2	236.0±7.5
•C_8H_9, p-$CH_3C_6H_4$C•H_2	167.4
•C_8H_9, m-$CH_3C_6H_4$C•H_2	167.4
•C_8H_9, o-$CH_3C_6H_4$C•H_2	167.4
•C_8H_9, 1-vinyl-cyclohexa-2,4-dienyl	247.7±14.2
•C_8H_9, 2-vinyl-cyclohexa-2,4-dienyl	249.8±14.2
•C_8H_9, 3-vinyl-cyclohexa-2,4-dienyl	269.4±14.2
•C_8H_9, 6-vinyl-cyclohexa-2,4-dienyl	284.5±14.2
•C_8H_{13}, CH_2=CHCH=CHC•H$(CH_2)_2CH_3$	130.5
•C_8H_{13}, CH_2=CHC•H$(CH_2)_3$CH=CH_2	130.5
•C_8H_{13}, bicyclooct-1-yl	92.0
•C_8H_{15}, CH_2=CHC•H$(CH_2)_4CH_3$	49.8
•C_8H_{15}, (E)-CH_3CH=C•$(CH_2)_4CH_3$	29.7
•C_8H_{15}, (Z)-$(CH_3)_2$C•CH=CHCH$(CH_3)_2$	9.2
•C_8H_{15}, cyclooctanyl	59.4
•C_8H_{15}, cyclo-[C•$(CH_2CH_3)(CH_2)_5$]	10.0
•C_9H_7, indenyl	297.1
•C_9H_9, indanyl-1	204.2±8.4
•C_9H_{11}, 2,6-dimethylbenzyl	124.7
•C_9H_{11}, 3,6-dimethylbenzyl	124.7
•C_9H_{11}, 3,5-dimethylbenzyl	124.7
•C_9H_{11}, C_6H_5C•$(CH_3)_2$	133.9±4.2
•C_9H_{11}, o-•$C_6H_4C_2H_5$	279.5±7.5
•C_9H_{17}, cyclononanyl	52.3
•$C_{10}H_7$, naphth-1-yl	401.7±5.4
•$C_{10}H_7$, naphth-2-yl	400.4±5.9
•$C_{10}H_{11}$, tetralin-1-yl	154.8±5.0
•$C_{10}H_{13}$, 1-phenyl-but-4-yl	192.0
•$C_{10}H_{13}$, $(C_6H_5CH_2)(C_2H_5)$C•H	184.5
•$C_{10}H_{13}$, $(C_6H_5CH_2CH_2)(CH_3)$C•H	184.5
•$C_{10}H_{13}$, $(C_6H_5$C•HC$H_2CH_2CH_3$	134.7
•$C_{10}H_{15}$, 1-adamantyl	51.5
•$C_{10}H_{15}$, 2-adamantyl	61.9
•$C_{10}H_{19}$, cyclodecanyl	32.2
•$C_{11}H_9$, 1-naphthylmethyl	252.7
•$C_{11}H_{21}$, cycloundecanyl	7.5
•$C_{12}H_{23}$, cyclododecanyl	-38.5
•$C_{13}H_9$, 9-fluorenyl	297.5
•$C_{13}H_{11}$, $(C_6H_5)_2$C•H	302.1±4.2
•$C_{13}H_{11}$, 9-methyl-9-fluorenyl	268.2
•$C_{14}H_{11}$, 9,10-dihydroanthracen-9-yl	261.0
•$C_{15}H_{11}$, 9-anthracenylmethyl	337.6
•$C_{15}H_{11}$, 9-phenanthrenylmethyl	311.3
•$C_{16}H_{31}$, CH_2=CHC•H$(CH_2)_{12}CH_3$	-118.8
•$C_{19}H_{15}$, trityl, $(C_6H_5)_3$C•	392.0±8.4
•$C_{35}H_{25}$, pentamethylcyclopentadienyl	67.4
CF	255.2±8
CF_2	-182.0±6.3
FC•(O)	-161.2±8.4
CHF	143.0±12.6
CClF	31.0±13.4
CCl	443.1±13.0
CCl_2	226
ClC•(O)	-21.8±2.5
CHCl	326.4±8.4
CClBr	267
CBr	510±63
CHBr	373±18
CBr_2	343.5
CI	570±35
CI_2	468±60
•CF_3	-465.7±2.1
•CHF_2	-238.9±4.2
•CH_2F	-31.8±4.2
•$CClF_2$	-279.0±8.4
•CCl_2F	-89.0±8.4
•CBrClF	-35.5±6.3
•CHClF	-60.7±10.0
•$CBrF_2$	-224.7±12.6
•CCl_3	71.1±2.5
•$CHCl_2$	93.3±4.2
•CH_2Cl	117.2±2.9
•CHBrCl	143±6
•$CHBr_2$	188.3±9.2
•CBr_2Cl	163±8
•$CBrCl_2$	124±8
•CBr_3	214.8
•CH_2Br	171.1±2.7
•CI_3	424.9±2.8
•CHI_2	314.4±3.3
•CH_2I	229.7±8.4
•C_2F, FC≡C•	460.0±21.0
•C_2Cl, ClC≡C•	568±26
•C_2F_3, CF_2=C•F	-192.0±8.4
•C_2F_2H, CF_2=C•H	-92.9±8.4
•C_2F_2H, CHF=C•F	-50.6±8.4
•CCl_2H, CHCl=C•Cl	234.7±8.4
•$CClH_2$, CH_2=C•Cl	>251
•C_2F_5, CF_3C•F_2	-892.9±4.2
•C_2HF_4, CF_3C•HF	-680.8±9.6
•C_2HF_4, CHF_2C•F_2	-664.8
•$C_2H_2F_3$, CF_3C•H_2	-517.1±8.4
•$C_2H_2F_3$, CHF_2C•HF	-456.0
•$C_2H_2F_3$, CH_2FC•F_2	-449.8
•$C_2H_2F_2Cl$, CF_2ClC•H_2	-310.9±7.0
•$C_2H_3F_2$, CH_3C•F_2	-302.5±8.4
•$C_2H_3F_2$, CHF_2C•H_2	-285.8
•$C_2H_3F_2$, CH_2FC•HF	-238.5
•C_2H_4F, CH_3C•HF	-70.3±8.4
•C_2H_4F, CH_2FC•H_2	-59.4±8.4
•$C_2H_2F_2Cl$, CF_2ClC•H_2	-315.2±6
•C_2F_4Cl, CF_2ClC•F_2	-686.0
•C_2HF_3Cl, $CClF_2$C•HF	-450.6±12.6
•C_2F_4Cl, CF_3C•FCl	-728.0
•$C_2F_3Cl_2$, CF_3C•Cl_2	-564.0
•C_2F_3ClBr, CF_3C•ClBr	-504.2±8.4
•C_2Cl, ClC≡C•	534±50
•C_2Cl_3, CCl_2=C•Cl	190±50
•C_2Cl_5, CCl_3C•Cl_2	35.1±5.4
•C_2HCl_4, $CHCl_2$C•Cl_2	23.4±8.4
•C_2HCl_4, CCl_3C•HCl	51.0
•$C_2H_2Cl_3$, CH_2ClC•Cl_2	26.4
•$C_2H_2Cl_3$, $CHCl_2$C•HCl	46.4
•$C_2H_2Cl_3$, CCl_3C•H_2	71.5±8
•$C_2H_3Cl_2$, CH_3C•Cl_2	42.5±1.7
•$C_2H_3Cl_2$, CH_2ClC•ClH	65.3
•$C_2H_3Cl_2$, $CHCl_2$C•H_2	90.1±0.8
•C_2H_4Cl, CH_3C•HCl	76.5±1.6
•C_2H_4Cl, CH_2ClC•H_2	93.0±2.4
•$C_2H_3Br_2$, CH_3C•Br_2	140.2±5.4
•C_2H_4Br, $BrCH_2$C•H_2	135.1

Radical	$\Delta_f H^o_{298}$/ kJ mol-1
$^{\bullet}C_2H_4Br$, $CH_3C^{\bullet}HBr$	126.8
$^{\bullet}C_2Br$, $CBrC^{\bullet}$	623.8
$^{\bullet}C_2Br_3$, $CBr_2C^{\bullet}Br$	385.3
$^{\bullet}C_2Br_5$, $CBr_3C^{\bullet}Br_2$	283.3
$^{\bullet}C_3H_6Cl$, $CH_3CH_2C^{\bullet}HCl$	56.6
$^{\bullet}C_3H_6Cl$, $CH_3C^{\bullet}ClCH_3$	29.9±0.6
$^{\bullet}C_3H_6Br$, $C^{\bullet}H_2CH_2CH_2Br$	120.1±1.3
$^{\bullet}C_3H_6Br$, $CH_3C^{\bullet}HCH_2Br$	96.7±5.9
$^{\bullet}C_3H_6Br$, $CH_3CH_2C^{\bullet}HBr$	107.5±2.5
$^{\bullet}C_6F_5$	-547.7±8.4
$^{\bullet}CH_3O$, $HOC^{\bullet}H_2$	-17.0±0.7
$^{\bullet}CH_2ClO$, $HOC^{\bullet}ClH$	-60.7±7.5
$^{\bullet}CHCl_2O$, $HOC^{\bullet}Cl_2$	-94.1±7.5
$^{\bullet}CH_2ClO$, $ClOC^{\bullet}H_2$	135.6±9.2
$^{\bullet}CH_2BrO$, $BrOC^{\bullet}H_2$	151±16
$^{\bullet}C_2H_3O$, $C^{\bullet}H=CHOH$	121±11
$^{\bullet}C_2H_3O$, $C^{\bullet}H_2CHO$	13.0±2
$^{\bullet}C_2H_5O$, $CH_3C^{\bullet}HOH$	-54.0
$^{\bullet}C_2H_4ClO$, $CH_3C^{\bullet}ClOH$	-108.4±8.8
$^{\bullet}C_2H_4ClO$, $C^{\bullet}H_2CHClOH$	-73.2±8.8
$^{\bullet}C_2H_3Cl_2O$, $C^{\bullet}H_2CCl_2OH$	-99.6±8.8
$^{\bullet}C_2H_5O$, $C^{\bullet}H_2CH_2OH$	-31±7
$^{\bullet}C_2H_3O$, oxiran-2-yl	149.8±6.3
$^{\bullet}C_3H_5O$,CH_2=CHC$^{\bullet}$HOH	0±8.4
$^{\bullet}C_3H_7O$, $CH_3CH_2C^{\bullet}HOH$	-81±4
$^{\bullet}C_3H_7O$, $(CH_3)C^{\bullet}HCH_2OH$	-78.7±8.4
$^{\bullet}C_3H_7O$, $HOCH_2CH_2C^{\bullet}H_2$	-66.9±8.4
$^{\bullet}C_3H_7O$, $(CH_3)_2C^{\bullet}OH$	-96.4
$^{\bullet}C_3H_7O$, $^{\bullet}CH_2CH(OH)CH_3$	-62.8±11.7
$^{\bullet}C_4H_9O$, $^{\bullet}CH_2C(OH)(CH_3)_2$	-147.3±8.4
$^{\bullet}C_2H_5O_3$, $C^{\bullet}H_2OCH_2OOH$	109.6±4.2
PhCH$^{\bullet}$OH	29.3±8.4
$Ph_2C^{\bullet}OH$	152.3±6.3
$^{\bullet}C_2H_5O$, $CH_3OC^{\bullet}H_2$	0±4.2
$^{\bullet}C_3H_7O$, $CH_3OC^{\bullet}HCH_3$	-57.7±8.4
$^{\bullet}C_3H_7O$, $CH_3CH_2OC^{\bullet}H_2$	-45.2±8.4
$^{\bullet}C_3H_7O$, $C^{\bullet}H_2CH_2OCH_3$	-7.1±4.2
$^{\bullet}C_4H_9O$, $(CH_3)_2CHOC^{\bullet}H_2$	-70.3±7.1
$^{\bullet}C_4H_9O$, $CH_3CH_2OC^{\bullet}HCH_3$	-81.2±4.2
$^{\bullet}C_4H_9O$, $C^{\bullet}H_2CH(CH_3)OCH_3$	-42.3±3.8
$^{\bullet}C_4H_9O$, $(CH_3)_2C^{\bullet}OCH_3$	-72.4±10
$^{\bullet}C_5H_{11}O$, $(CH_3)_3COC^{\bullet}H_2$	-102.5±8.4
$^{\bullet}C_2H_5O_2$, $HOCH_2C^{\bullet}HOH$	-220.1±8.4
C$^{\bullet}$H=C=O, ketenyl	177.5±8.8
HC$^{\bullet}$(O)	42.5±0.5

Radical	$\Delta_f H^o_{298}$/ kJ mol-1
C$^{\bullet}$CO	381.2±2.1
$CH_3C^{\bullet}(O)$	-10.3±1.8
$CF_3C^{\bullet}(O)$	-608.7
$CH_2ClC^{\bullet}(O)$	-21±12.6
$CHCl_2C^{\bullet}(O)$	-17.6±23
$CCl_3C^{\bullet}(O)$	-19.7
$CH_3CH_2C^{\bullet}(O)$	-31.7±3.4
$CH_2CHC^{\bullet}(O)$	88.5
$CH_2C(CH_3)C^{\bullet}(O)$	58.6±16.7
$CH_3CH_2CH_2C^{\bullet}(O)$	54.4±4.2
$(CH_3)_2CHC^{\bullet}(O)$	-64.0±3.8
$(CH_3)_3CC^{\bullet}(O)$	-102.9±6.3
$C_6H_5C^{\bullet}(O)$	116.3±10.9
$HC(O)CH_2^{\bullet}$	10.5±9.2
$ClC(O)CH_2^{\bullet}$	-52.7±13
E-C$^{\bullet}$HClC(O)H	-27.2±10.5
Z-C$^{\bullet}$HClC(O)H	-23.4±10.5
C$^{\bullet}Cl_2C(O)H$	-55.6±14.2
E-C$^{\bullet}$HClC(O)Cl	-88.7±15.1
$C^{\bullet}H_2C(O)F$	-273.0±5.8
Z-C$^{\bullet}$HClC(O)Cl	-84.9±13.8
C$^{\bullet}Cl_2C(O)Cl$	-101.7±15.5
$CH_3C(O)CH_2^{\bullet}$	-34±3
$CH_3C(O)C^{\bullet}HCH_3$	-70.3±7.1
$CH_3C(O)C^{\bullet}=CH_2$	113.4
$C_2H_5C(O)C^{\bullet}HCH_3$	-107.5±20.9
$iPrC(O)C^{\bullet}(CH_3)_2$	-173.6±20.9
$tC_4H_9C(O)C^{\bullet}H_2$	-115.5±12.6
$PhC(O)C^{\bullet}H_2$	84.5±12.6
$PhC(O)C^{\bullet}HCH_3$	41.4±20.9
$PhC^{\bullet}HC(O)CH_2Ph$	134.3±20.9
$PhC(O)OC^{\bullet}H_2$	-69.9
$^{\bullet}$C(O)OH-trans	≥-194.6±2.9
$^{\bullet}$C(O)OH-cis	-219.7
$^{\bullet}C(O)OCH_3$	-161.5
$C^{\bullet}H_2C(O)OH$	-248.9±12.0
$C^{\bullet}H(CH_3)C(O)OH$	-293±3
$C^{\bullet}H_2C(O)OCH_3$	-236.8±8.4
$C^{\bullet}H_2C(O)OCH_2CH_3$	-260.2±12.6
$C^{\bullet}H_2C(O)OPh$	-28.0
$^{\bullet}C_4H_7O$, tetrahydrofuran-2-yl	-18.0±6.3
$^{\bullet}C_4H_8O$, cyclopentanon-2-yl	-41.8±12.6
$^{\bullet}C_4H_7O_2$, 1,4-dioxan-2-yl	-131.8±12.6
$^{\bullet}C_7H_5O_2$, 2-C(O)OH-$^{\bullet}C_6H_4$	-33.0

Radical	$\Delta_f H^o_{298}$/ kJ mol-1
$^{\bullet}C_7H_5O_2$, 3-C(O)OH-$^{\bullet}C_6H_4$	-35.0
$^{\bullet}C_7H_5O_2$, 4-C(O)OH-$^{\bullet}C_6H_4$	-36.0
$^{\bullet}CH_3O_2$, $C^{\bullet}H_2OOH$	66.1
$^{\bullet}C_2H_5O_2$, $C^{\bullet}H_2CH_2OOH$	46.0±4.6
$^{\bullet}C_2H_5O_2$, $CH_3CH^{\bullet}OOH$	26.9
$^{\bullet}C_3H_7O_2$, $CH_3CH^{\bullet}CH_2OOH$	10.9±5.4
$^{\bullet}C_3H_7O_2$, $C^{\bullet}H_2CH(OOH)CH_3$	2.9±6.3
$^{\bullet}C_4H_9O_2$, $(CH_3)_2C^{\bullet}CH_2OOH$	-30.1±5.4
$^{\bullet}C_4H_9O_2$, $C^{\bullet}H_2C(CH_3)_2OOH$	-26.8±5.4
$^{\bullet}C_2H_3O_3$, $C^{\bullet}H_2C(O)OOH$	-137.9
$^{\bullet}CHN_2$	494.5
$^{\bullet}CH_2N$=CH_2	263.6±12.6
$^{\bullet}CH_2NH_2$	151.9±8.4
$CH_3C^{\bullet}HNH_2$	111.7±8.4
$(CH_3)_2C^{\bullet}NH_2$	69.9±8.4
$^{\bullet}CH_2NHCH_3$	156.6
$^{\bullet}CH_2N(CH_3)_2$	148.0
$(C_2H_5)_2NC^{\bullet}HCH_3$	68.6±2.1
$^{\bullet}CH_2N(CH_3)Ph$	266.0±12.6
$^{\bullet}$CN	439.3±2.9
$^{\bullet}CH_2CN$	252.6±4
$CH_3C^{\bullet}HCN$	226.7±12.6
$^{\bullet}CH_2CH_2CN$	245.4±12.6
$(CH_3)_2C^{\bullet}CN$	190.4±12.6
$Ph(CH_3)C^{\bullet}CN$	248.5±8.4
$NCC^{\bullet}HCH_2CN$	381.8±12.6
$^{\bullet}CH_2NC$	334.7±16.7
$^{\bullet}C(O)NC$	210.0±10
$^{\bullet}C(O)NH_2$	-15.1±4
C$^{\bullet}$NN	569±21
HC$^{\bullet}$NN	460±8
$H_2C^{\bullet}NN$	292.5±2.1
$^{\bullet}CH_2NO$	157±4
$^{\bullet}CH_2NO_2$	115.1±12.6
$CH_3C^{\bullet}HNO_2$	61.9±12.6
$(CH_3)_2C^{\bullet}NO_2$	6.3±12.6
$PhC^{\bullet}HNO_2$	169.0±12.6
$^{\bullet}C_6H_6N$, 3-NH_2-C_6H_4	320.1
$^{\bullet}C_6H_6N$, 4-NH_2-C_6H_4	327.8
$^{\bullet}C_6H_4NO_2$, 3-NO_2-C_6H_4	340.6±10.0
$^{\bullet}C_6H_4NO_2$, 4-NO_2-C_6H_4	302.7
$^{\bullet}C_6H_4CH_3$, 2-Me-C_6H_4	315.1±10.5
$^{\bullet}C_6H_4CH_3$, 4-Me-C_6H_4	296.6±9.6
$^{\bullet}C_6H_3N_2O_4$, 3,5-$(NO_2)_2$-C_6H_3	305.4
$^{\bullet}C_7H_6NO_2$, 2-Me-4-NO_2-C_6H_3	295.4±8.4
$^{\bullet}C_4H_3N$, pyrrol-2-yl	385.8

Radical	$\Delta_f H^o_{298}$/ kJ mol-1
•C_4H_3N, pyrrol-3-yl	385.8
•C_4H_8N, pyrrolidin-2-yl	142.7±12.6
•C_5H_4N, pyrid-2-yl	362.0
•C_5H_4N, pyrid-3-yl	391.0
•C_5H_4N, pyrid-4-yl	391.0
•$C_4H_7N_2$, piperad-2-yl	119.7
•$C_4H_3N_2$, pyrazin-2-yl	409.2±12.6
•$C_4H_3N_2$, pyrimid-2-yl	388.0±12.6
•$C_4H_3N_2$, pyrimid-4-yl	409.0±12.6
•$C_4H_3N_2$, pyrimid-5-yl	446.4±12.6
•$CH(NO_2)_2$	139.1
•$C(NO_2)_3$	201.2
•$CH_2C(NO_2)_3$	150.6
•$CH_2CH(NO_2)_2$	103.3
•$CH_2CH_2C(NO_2)_3$	133.9
•$CH_2N(NO_2)CH_2C(NO_2)_3$	173.6
•$CH_2N(NO_2)CH_2CH(NO_2)_2$	126.4
•$CH_2CH_2N(NO_2)CH_2C(NO_2)_3$	168.6
•$CH_2CH_2ONO_2$	37.7
•$CH_2(ONO_2)CHCH_2ONO_2$	-25.5
•$CH(CH_2ONO_2)_2$	-57.3
•$CH_2C(CH_2ONO_2)_3$	-158.2
•CH_2NHNO_2	164.8
•$CH_2N(NO_2)CH_3$	149.4
•$CH_2N(NO_2)_2$	210.5
•$CH_2CH_2N(NO_2)CH_3$	144.3
•$CH_2N(NO_2)CH_2N(NO_2)CH_3$	202.1
•$CH_2N(NO_2)(CH_2)N(NO_2)CH_3$	173.2
C•(S)H	300.4±8.4
•CH_2SH	151.9±8.4
•CH_2SCH_3	136.8±5.9
•CH_2SPh	268.6±12.6
•CH_2SOCH_3	23.8±12.6
HOC•(S)S	110.5
•$CH_2SO_2CH_3$	-177.0±12.6
•CH_2SO_2Ph	-57.3±12.6
PhC•HSO_2CH_3	-109.2±12.6
PhC•HSO_2Ph	7±12.6
Ph_2C•SO_2Ph	102±12.6
Ph_2C•SPh	435.6±12.6
NC•(O)	127.2
•CNH	207.9±12.1
•CNO	323±30
•CH_2SiMe_3	-32±6
•$CH_2C(CH_3)_2SiMe_3$	-125
•CP	450±9
(2) Oxygen-Centered Species	
HO•	37.3±0.3
FO•	109±10
ClO•	101.63±0.1
BrO•	126.2±1.7
IO•	115.9±5.0
HOO•	13.4±2.1
FOO•	25.4±2
ClOO•	98.0±4
BrOO•	108±40
IOO•	96.6±15
OFO•	378.6±20
OClO•	95.4
ClOOClO•	142±12
ClClO•	90±30
NCO•	184.1
CNO•	386.6
HONNO•	172
sym-ClO_3	217.2±21
HSO•	-21.8±2.1
HSOO•	112
CH_3SOO•	76
CF_3SO_2O•	-912
NCO•	184.0
O_2NO•	71.1
ONOO•	82.8
$HOS(O)_2O$•	-511.7
CH_3O•	21.0±2.1
CF_3O•	-635.1±7.1
CCl_3O•	-38.1±9.2
CH_2ClO•	-21.3±9.2
$CHCl_2O$•	-32.2±9.2
CH_2=CH-O•	18.4±1.3
CF_3CHFO•	-851.0
C_2H_5O•	-13.6±3.3
CH_3CHClO•	-61.9±12.1
CH_3CCl_2O•	-91.6±11.7
nC_3H_7O•	-30.1±8.4
iC_3H_7O•	-48.5±3.3
$(CH_3)_2CClO$•	-108.4±8.4
nC_4H_9O•	-62.8
sC_4H_9O•	-69.5
tC_4H_9O•	-85.8±3.8
CH_2=$CHCH_2O$•	87.0
C_6H_5O•	48.5±2.9
o-Cl-C_6H_4O•	30.6
C_6Cl_5O•	~63
p-Cl-C_6H_4O•	~9
o-OH-C_6H_4O•	-186.3
p-OH-C_6H_4O•	-143.6
o-CH_3O-C_6H_4O•	-125.5
p-CH_3O-C_6H_4O•	-81.1
$C_6H_5CH_2O$•	136.0±12.6
$C_{10}H_7O$•, naphthoxy-1	165.3
$C_{10}H_7O$•, naphthoxy-2	174.1
HC(O)O•	-129.7±12.6
FC(O)O•	368.0
$CH_3C(O)O$•	-179.9±12.6
$CF_3C(O)O$•	-797.0
$CF_3OC(O)O$•	-958.1±16.7
$C_6H_5C(O)O$•	-50.2±16.7
CH_3OO•	20.1±5.1
C_2H_3OO•, CH_2=CHOO•	101.7±1.7
C_2H_5OO•	-28.5±9.6
C_3H_5OO•, CH_2=$CHCH_2OO$•	88.7
iC_3H_7OO•	-65.4±11.3
C_4H_7OO•, CH_3CH=$CHCH_2OO$•	82.6±5.3
tC_4H_9OO•	-101.5±9.2
neo-$C_5H_{11}OO$•	-115.5
$HOCH_2OO$•	-162.1
$HOOCH_2CH_2OO$•	100
$C_6H_5CH_2OO$•	114.6±4.2
c-$C_6H_{11}OO$•	-25.0±10.5
$(C_2H_5)N(CH3)CHOO$•	-36.0±12.6
CF_3OO•	-635.0
CF_2ClOO•	-406.7±14.6
$CFCl_2OO$•	-213.7
CH_2ClOO•	-5.1±13.6
$CHCl_2OO$•	-19.2±11.2
CCl_3OO•	-20.9±8.9
$CH_3CHClOO$•	-54.7±3.4
CH_3CCl_2OO•	-63.8±9.8
CH_3OCH_2OO•	-142.2±4.2
$CH_3C(O)CH_2OO$•	-142.1±4
$CH_3C(O)OO$•	-154.4±5.8
HOOO•	29.7±8.4
CH_3OOO•	33.4±12.6
C_2H_5OOO•	5.4±12.6

Radical	$\Delta_f H^o_{298}$/ kJ mol-1
(3) Nitrogen-Centered Species	
ON	90.29±0.17
NO_2	33.10±0.8
N_2O	82.05±0.4
NH	357±1
$^{\bullet}NH_2$	186.2±1.0
$^{\bullet}$NNH	249.5
$^{\bullet}$NCO	131.8
$^{\bullet}N_3$	414.2±20.9
$^{\bullet}N_2H_3$	243.5
(Z)-N_2H_2	213.0±10.9
NF	209.2
$^{\bullet}NF_2$	42.3±8
$^{\bullet}$NHF	112±15
NBr	301±21
HNO	107.1±2.5
FNO	-65.7±1.7
ClNO	51.71±0.42
BrNO	82.13±0.8
INO	112.1±20.9
NCO	120.9
NCN	464.8±2.9
NSi	372±63
$NH_2C(O)N^{\bullet}H$	0.8±12.6
$CH_3C(O)N^{\bullet}H$	-6.7±12.6
$NH_2C(S)N^{\bullet}H$	194±12.6
$CH_3C(S)N^{\bullet}H$	173±12.6
$PhC(S)N^{\bullet}H$	307±12.6
$HCON^{\bullet}H$	49.8±12.6
$NH_2C(NH)N^{\bullet}H$	250.6±12.6
$^{\bullet}$NHCN	319.2±2.9
$CH_2N^{\bullet}H$	104.6±12.6
$CH_3N^{\bullet}H$	184.1±8.4
$tBuN^{\bullet}H$	95.4±12.6
$C_6H_5CH_2N^{\bullet}H$	288.3±12.6
$C_6H_5N^{\bullet}H$	244.3±4.2
$(CH_3)_2N^{\bullet}$	158.2±4.2
$(C_6H_5)(CH_3)N^{\bullet}$	241.0±6.3
$(C_6H_5)_2N^{\bullet}$	366.0±6.3
1-pyrrolyl	269.2±12.6
carbazol-9-yl	383.3±8.4
$CH_3N_2^{\bullet}$	215.5±7.5
$C_2H_5N_2^{\bullet}$	187.4±10.5
$iC_3H_7N_2^{\bullet}$	146.0±8.4
$nC_4H_9N_2^{\bullet}$	140.6±8.4
$tC_4H_9N_2^{\bullet}$	97.5±4.2
$(NO_2)HN^{\bullet}$	162.3
$(CH_3)(NO_2)N^{\bullet}$	139.0
$(NO_2)_2N^{\bullet}$	200.0
$CH_3N^{\bullet}CH_2N(NO_2)CH_3$	185.4
(4) Sulfur-Centered Species	
$HOS^{\bullet}$	-6.7±2.1
$HC(O)S^{\bullet}$	56.5
$HS^{\bullet}O_2$	-221.8
$HOS^{\bullet}O_2$	-384.9
$NCS^{\bullet}$	300±8
$HS^{\bullet}$	143.0±0.8
$CH_3S^{\bullet}$	124.7±1.7
$C_2H_5S^{\bullet}$	101
$nC_3H_7S^{\bullet}$	80
$iC_3H_7S^{\bullet}$	74.9±8.4
$tC_4H_9S^{\bullet}$	43.9±8.4
$C_6H_5S^{\bullet}$	242.7±4.6
$C_6Cl_5S^{\bullet}$	~184
$C_6H_5CH_2S^{\bullet}$	246
$CH_3S^{\bullet}O$	-67±10
$CH_3S^{\bullet}O_2$	-239.3
$HSS^{\bullet}$	115.5±14.6
$CH_3SS^{\bullet}$	68.6±8.4
$C_2H_5SS^{\bullet}$	43.5±8.4
$iC_3H_7SS^{\bullet}$	13.8±8.4
$tC_4H_9SS^{\bullet}$	-19.2±8.4
$HOC(S)S^{\bullet}$	110.5±4.6
$HC(O)S^{\bullet}$	56.5
SF	13.0±6.3
SF_2	-296.7±16.7
SF_3	-503.0±33.5
SF_4	-763.2±20.9
SF_5	-879.9±15.1
$ClS^{\bullet}$	156.5±16.7
SN	263.6±105
SCl	156.5±16.7
(5) Si-, Ge-, Sn-, Pb-Centered Species	
SiF	-20.1±12.6
SiF_2	-638±6
$^{\bullet}SiF_3$	-987±20
SiCl	198.3±6.7
$SiCl_2$	-169±3
$^{\bullet}SiCl_3$	322±8
SiBr	235±46
$SiBr_2$	46±8
$^{\bullet}SiBr_3$	-201.7±63
SiI	313.8±42
SiI_2	92.5±8.4
$^{\bullet}SiI_3$	35.3±63
SiH	376.6±8.4
$SiH_2(^1A_1)$	273±2
$SiH_2(^3B_1)$	360.7
$^{\bullet}SiH_3$	200.4±2.5
$MeSi^{\bullet}H_2$	141±6
$Me_2Si^{\bullet}H$	78±6
$Me_3Si^{\bullet}$	15±7
$^{\bullet}Si_2H_3$	~402
$H_3SiSi^{\bullet}H_2$	234±6
$C_6H_5Si^{\bullet}H_2$	274
$H_3SiSi^{\bullet}H$	312±8
$MeSi^{\bullet}$	302.2
$MeSi^{\bullet}H$	202±6
$Me_2Si^{\bullet\bullet}$	135±8
SiN	313.8±42
$^{\bullet}GeH_3$	221.8±8.4
GeF	-71±10
GeF_2	-574±20
$^{\bullet}GeF_3$	-807±50
GeCl	69±18
$GeCl_2$	-171±5
$^{\bullet}GeCl_3$	-268±50
GeBr	137±5
$GeBr_2$	-61±5
$^{\bullet}GeBr_3$	-119±50
GeI	211±25
GeI_2	50.2±4
$^{\bullet}GeI_3$	42±50
SnF	-95±7.2
SnF_2	-511±9.2
$^{\bullet}SnF_3$	-647±50
SnCl	35±12
$SnCl_2$	-202.6±7.1
$^{\bullet}SnCl_3$	-292±50
SnBr	76±12

Radical	$\Delta_f H^o_{298}$/ kJ mol-1	Radical	$\Delta_f H^o_{298}$/ kJ mol-1	Radical	$\Delta_f H^o_{298}$/ kJ mol-1
$SnBr_2$	-119±2.8	PbH	236.2±19.2	PbBr	70.9±42
$^{\bullet}SnBr_3$	-159±50	PbF	-80.3±10.5	$PbBr_2$	-104.4±6.3
SnI	173±12	PbF_2	-435.1±8.4	$^{\bullet}PbBr_3$	-104±80
SnI_2	-8.1±4.2	$^{\bullet}PbF_3$	-490±60	PbI	107.4±37.7
$^{\bullet}SnI_3$	-8±50	PbCl	15.1±50	PbI_2	-3.2±4.2
$^{\bullet}Sn(CH_3)_3$	132.2	$PbCl_2$	-174.1±1.3	$^{\bullet}PbI_3$	22±80
$^{\bullet}Sn(C_6H_5)_3$	518.8±21	$^{\bullet}PbCl_3$	-178±80		

TABLE 5. Bond Dissociation Energies of Some Organic Molecules

D^0_{298}(R-X)/ kJ mol^{-1} of some organic compounds are listed below. All data are from Tables 1 and 3.

	X = H	F	Cl	Br	I	OH	OCH_3	NH_2	NO	CH_3	$COCH_3$	CF_3	CCl_3
R = H	435.7799	569.658	431.361	366.16	298.26	497.10	440.2	450.08	199.5	439.3	374.0	445.2	392.5
CH_3	439.3	460.2	350.2	294.1	238.9	384.93	351.9	356.1	172.0	377.4	351.9	429.3	362.3
C_2H_5	420.5	447.4	352.3	292.9	233.5	391.2	355.2	352.3	171.5	370.3	347.3	–	–
i-C_3H_7	410.5	483.8	354.0	299.2	234.7	397.9	360.7	357.7	152.7	369.0	340.2	–	–
t-C_4H_9	400.4	495.8	351.9	292.9	227.2	398.3	353.1	355.6	167	363.6	329.3	–	–
C_6H_5	472.2	525.5	399.6	336.4	272.0	463.6	418.8	429.3	226.8	426.8	406.7	463.2	388.7
$C_6H_5CH_2$	375.5	412.8	299.9	239.3	187.8	334.1	–	306.7	123	325.1	299.7	365.7	–
CCl_3	392.5	439.3	296.6	231.4	168	–	–	–	125	362.3	–	332.2	285.8
CF_3	445.2	546.8	365.3	296.2	227.2	≤482.0	–	–	167	429.3	–	413.0	332.2
C_2F_5	429.7	532.2	346.0	283.3	219.2	–	–	–	–	–	–	424.3	–
CH_3CO	374.0	511.7	354.0	292.0	223.0	459.4	424.3	414.6	–	204.4	521.7	–	469.0	–
CN	528.5	482.8	422.6	364.8	320.1	–	–	–	211.3	439.3	–	435.1	–
C_6F_5	487.4	485	383.3	~328	<301.7	446.9	–	–					

TABLE 6. Bond Dissociation Energies in Diatomic Cations

From thermochemistry, we have

$$D^o_{298}(A^+–B) \equiv \Delta_f H^o(A^+) + \Delta_f H^o(B) - \Delta_f H^o(AB^+) = D^o_{298}(A–B) + IP(A) – IP(AB)$$

Thus, $D^o_{298}(A^+–B)$ may be derived using the Table 1 and the ionization potentials of species A and AB. The following table has been arranged in an alphabetical order of the atoms. The **boldface** in the species indicates the dissociated fragment. The details are described in the *Comprehensive Handbook of Chemical Bond Energies*, by Yu-Ran Luo, Taylor & Francis, 2006.

$A^+–B$	D^o_{298} kJ/ mol^{-1}	$A^+–B$	D^o_{298} kJ/ mol^{-1}	$A^+–B$	D^o_{298} kJ/ mol^{-1}	$A^+–B$	D^o_{298} kJ/ mol^{-1}
Ag$^+$–Ag	167.9±8.7	**Ar**$^+$–Ne	7.5±0.8	**B**$^+$–B	187	**Ba**$^+$–O	441.4±15
Ag$^+$–Cl	32±30	**As**$^+$–As	364±22	**B**$^+$–Br	164±21	**Be**$^+$–Ar	49.0±2.4
Ag$^+$–F	24±27	**As**$^+$–H	290.8±3.0	**B**$^+$–C	284±58	**Be**$^+$–Au	410±29
Ag$^+$–H	43.5±5.9	**As**$^+$–O	495	**B**$^+$–Cl	308±21	**Be**$^+$–Be	187.0
Ag$^+$–O	123±5	**As**$^+$–P	367±59	**B**$^+$–F	460±10	**Be**$^+$–Cl	417±50
Ag$^+$–S	123±13	**As**$^+$–S	433.2±12.5	**B**$^+$–H	198±5	**Be**$^+$–F	575±98
Al$^+$–Al	121	**Au**$^+$–Al	170±30	**B**$^+$–O	326±48	**Be**$^+$–H	307.3±5.0
Al$^+$–Ar	15.47	**Au**$^+$–Au	234.5	**B**$^+$–Pt	314±98	**Be**$^+$–O	362.0±6.2
Al$^+$–Ca	148.5	**Au**$^+$–B	329±50	**B**$^+$–Se	298±98	**Bi**$^+$–Bi	199±10
Al$^+$–Cl	173±42	**Au**$^+$–Be	401±29	**B**$^+$–Si	365±15	**Bi**$^+$–O	174
Al$^+$–F	314±21	**Au**$^+$–F	79	**Ba**$^+$–Ar	11.85	**Bi**$^+$–S	179±50
Al$^+$–Kr	5.54	**Au**$^+$–Ge	292±24	**Ba**$^+$–Br	418±10	**Bi**$^+$–Se	184±29
Al$^+$–O	166.7±12.0	**Au**$^+$–H	143.5	**Ba**$^+$–Cl	468.2±10	**Bi**$^+$–Te	125±50
Al$^+$–Se	114±49	**Au**$^+$–I	230~280	**Ba**$^+$–D	245.2±9.6	**Bi**$^+$–Tl	100±42
Ar$^+$–Ar	130.323±0.087	**Au**$^+$–Xe	130±13	**Ba**$^+$–F	640±29	**Bk**$^+$–O	610
Ar$^+$–He	2.9±0.8	**B**$^+$–Ar	32.7	**Ba**$^+$–I	335±10	**Br**$^+$–Br	318.858±0.024

A^+–B	D^o_{298} kJ/mol^{-1}
Br$^+$–C	451.5±8.6
Br$^+$–Cl	303.000±0.048
Br$^+$–F	251.5±12.6
Br$^+$–H	379.26±2.89
Br$^+$–O	365.7±3.1
C$^+$–Ar	72.3
C$^+$–Br	398±8.6
C$^+$–C	601.9±19.3
C$^+$–Cl	614
C$^+$–F	721±40
C$^+$–H	397.848±0.013
C$^+$–N	524.5±4.2
C$^+$–O	810.7±0.8
C$^+$–P	587±50
C$^+$–S	706.6±2.1
C$^+$–Se	587±50
Ca$^+$–Al	144.7
Ca$^+$–Ar	12.99±0.60
Ca$^+$–Au	306±29
Ca$^+$–Br	417.6±10
Ca$^+$–Ca	104.1
Ca$^+$–Cl	433.4±12
Ca$^+$–F	556.5±8.4
Ca$^+$–H	284.2±10
Ca$^+$–I	293.7±10.8
Ca$^+$–Kr	18.60±0.72
Ca$^+$–Ne	4.95±0.06
Ca$^+$–O	348±5
Ca$^+$–Xe	25.38±0.96
Cd$^+$–Cd	122.5±10
Cd$^+$–H	179.5
Ce$^+$–Au	278±34
Ce$^+$–Br	341.0
Ce$^+$–C	254±96
Ce$^+$–Ce	207±42
Ce$^+$–Cl	429.5
Ce$^+$–F	586±63
Ce$^+$–I	295.5
Ce$^+$–Ir	530±96
Ce$^+$–N	494±63
Ce$^+$–O	852±15
Ce$^+$–Pd	255±53
Ce$^+$–Pt	467±96
Ce$^+$–Rh	423±96
Ce$^+$–S	524±59
Cl$^+$–Ar	169
Cl$^+$–Cl	386.02±0.30
Cl$^+$–D	457.284±0.017
Cl$^+$–F	291±10
Cl$^+$–H	452.714±0.018
Cl$^+$–N	650±10
Cl$^+$–O	468.0±2.1

A^+–B	D^o_{298} kJ/mol^{-1}
Co$^+$–Ar	52.89±0.06
Co$^+$–Br	>289
Co$^+$–C	351±29
Co$^+$–Cl	285±12
Co$^+$–Co	269
Co$^+$–D	199.6±5.8
Co$^+$–H	195±6
Co$^+$–He	16.4±0.4
Co$^+$–I	211.7±8.4
Co$^+$–Kr	68.37±0.18
Co$^+$–Ne	12.8±0.4
Co$^+$–O	317.3±4.8
Co$^+$–S	288.3±8.7
Co$^+$–Si	317.1±6.7
Co$^+$–Xe	85.7±6.8
Cr$^+$–Ar	31.7±3.9
Cr$^+$–C	277±24
Cr$^+$–Cl	>211
Cr$^+$–Cr	129
Cr$^+$–D	135±9
Cr$^+$–F	279±42
Cr$^+$–H	136±9
Cr$^+$–He	7.8±0.4
Cr$^+$–Ne	9.5±0.4
Cr$^+$–O	276
Cr$^+$–S	258.6±16.4
Cr$^+$–Si	203±15
Cr$^+$–Xe	71.9±10.0
Cs$^+$–Ar	8.2
Cs$^+$–Br	60.5±10
Cs$^+$–Cl	107.4±10
Cs$^+$–Cs	62.6±9.6
Cs$^+$–F	43.7±10
Cs$^+$–He	5.1
Cs$^+$–I	29.3±10
Cs$^+$–Kr	15.1
Cs$^+$–Na	48.1±4.2
Cs$^+$–Ne	6.11
Cs$^+$–O	59
Cs$^+$–Rb	68.3±10
Cs$^+$–Xe	14.7
Cu$^+$–Ar	51.9±6.8
Cu$^+$–Cl	91±10
Cu$^+$–Cu	155.2±7.7
Cu$^+$–F	117±21
Cu$^+$–Ge	231±23
Cu$^+$–H	93±13
Cu$^+$–Kr	24.3±0.8
Cu$^+$–O	133.9±11.6
Cu$^+$–S	203.3±14.5
Cu$^+$–Si	260±8
Cu$^+$–Xe	102.1±5.8

A^+–B	D^o_{298} kJ/mol^{-1}
D$^+$–D	263.4405±0.0003
Dy$^+$–Br	324.2
Dy$^+$–Cl	407.9
Dy$^+$–Cu	196±42
Dy$^+$–F	535±24
Dy$^+$–I	279.9
Dy$^+$–O	597±15
Er$^+$–Br	315.8
Er$^+$–Cl	406.7
Er$^+$–F	546±34
Er$^+$–I	271.6
Er$^+$–O	583±15
Es$^+$–O	470±60
Eu$^+$–Ag	85±50
Eu$^+$–Au	252±97
Eu$^+$–Br	333.8
Eu$^+$–Cl	430.7
Eu$^+$–F	543±29
Eu$^+$–I	290.7
Eu$^+$–O	393±15
Eu$^+$–S	257±32
F$^+$–Ar	161.1
F$^+$–F	325.393±0.096
F$^+$–He	181.62±0.08
F$^+$–Kr	152.4
F$^+$–Xe	188
Fe$^+$–Ar	14.2±7.7
Fe$^+$–Br	>293
Fe$^+$–C	356.1±17.2
Fe$^+$–Cl	>343
Fe$^+$–Co	259±21
Fe$^+$–Cr	209±29
Fe$^+$–Cu	222±29
Fe$^+$–D	227
Fe$^+$–F	360 - 423
Fe$^+$–Fe	272
Fe$^+$–H	211.2±9.6
Fe$^+$–I	>239
Fe$^+$–Kr	33.5±6.7
Fe$^+$–N	485
Fe$^+$–Nb	285±21
Fe$^+$–Ni	268±21
Fe$^+$–O	343.3±1.9
Fe$^+$–S	295.2±5.8
Fe$^+$–Sc	200±21
Fe$^+$–Si	277±9
Fe$^+$–Ta	301±21
Fe$^+$–Ti	251±25
Fe$^+$–V	314±21
Fe$^+$–Xe	46.0±5.8
Ga$^+$–Bi	62±98
Ga$^+$–Br	56.5±16

A^+–B	D^o_{298} kJ/mol^{-1}
Ga$^+$–Cl	86±21
Ga$^+$–F	136±15
Ga$^+$–Ga	126.3
Ga$^+$–I	41.6±15
Ga$^+$–O	46±50
Ga$^+$–Sb	38±96
Ga$^+$–Te	19±29
Gd$^+$–Cd	122.5±10
Gd$^+$–H	179.5
Ge$^+$–Br	398±42
Ge$^+$–C	223±31
Ge$^+$–Cl	473±50
Ge$^+$–F	565±21
Ge$^+$–Ge	274±10
Ge$^+$–H	377±84
Ge$^+$–O	344±21
Ge$^+$–S	283±21
Ge$^+$–Se	234±10
Ge$^+$–Si	268±21
Ge$^+$–Te	233±19
H$^+$–D	261.1021±0.0002
H$^+$–H	259.4659±0.0002
He$^+$–H	123.9
He$^+$–He	229.687±0.019
Hf$^+$–O	724±21
Hg$^+$–Ar	22.2±1.2
Hg$^+$–H	207
Hg$^+$–Hg	134
Hg$^+$–Kr	37.9±1.3
Hg$^+$–Xe	72.2±1.3
Ho$^+$–Ag	155±61
Ho$^+$–Au	250±60
Ho$^+$–Br	320.6
Ho$^+$–Cl	410.3
Ho$^+$–Cu	214±35
Ho$^+$–F	542±50
Ho$^+$–Ho	88±96
Ho$^+$–I	270.4
Ho$^+$–O	551±25
I$^+$–Br	184.90±0.02
I$^+$–Cl	247.5±0.4
I$^+$–F	262.9±2.1
I$^+$–H	304.70±0.10
I$^+$–I	262.90±0.04
I$^+$–O	316.3±10.5
In$^+$–Br	65.2±12.6
In$^+$–Cl	193±21
In$^+$–F	148±50
In$^+$–I	51.5±21
In$^+$–In	81±30
In$^+$–S	171±50
In$^+$–Sb	73±50

A^+–B	D^o_{298} kJ/mol^{-1}
In$^+$–Se	118±50
In$^+$–Te	41±50
Ir$^+$–C	544±96
Ir$^+$–D	302.8±5.8
Ir$^+$–H	305.7±5.8
Ir$^+$–O	247
K$^+$–Ar	14±7
K$^+$–Br	35.7±10.5
K$^+$–Cl	51±19
K$^+$–He	6.00
K$^+$–I	18±45
K$^+$–K	83.86±0.15
K$^+$–Kr	15.8
K$^+$–Li	59.9±5.9
K$^+$–Na	58.69±0.08
K$^+$–Ne	7.79
K$^+$–O	13
K$^+$–Xe	19.5
Kr$^+$–Ar	55.31±0.14
Kr$^+$–H	464
Kr$^+$–He	2.1±0.8
Kr$^+$–Kr	110.967±0.033
Kr$^+$–N	133±13
Kr$^+$–Ne	3.8±0.8
La$^+$–Au	436±97
La$^+$–Br	425.9
La$^+$–C	427±33
La$^+$–Cl	503.6
La$^+$–F	589±34
La$^+$–H	243±9
La$^+$–I	392.4
La$^+$–Ir	356±97
La$^+$–O	875±25
La$^+$–Pt	522±78
La$^+$–Rh	345±97
La$^+$–S	629±96
La$^+$–Si	277.0±9.6
Li$^+$–Ar	33±14
Li$^+$–Bi	91±50
Li$^+$–Br	41.8±10.6
Li$^+$–Cl	66±15
Li$^+$–F	7±21
Li$^+$–He	10.66
Li$^+$–I	51.1±6.3
Li$^+$–Kr	48.1
Li$^+$–Li	137.3±6.3
Li$^+$–Ne	15.32
Li$^+$–O	38.9±9.6
Li$^+$–Sb	129.6±13.9
Li$^+$–Xe	56.4
Lu$^+$–Br	86.1
Lu$^+$–Cl	180.6
Lu$^+$–F	376.8
Lu$^+$–H	204±15
Lu$^+$–I	40.7
Lu$^+$–O	524±15
Lu$^+$–Si	107±13
Mg$^+$–Ar	19.20
Mg$^+$–Au	267±29
Mg$^+$–Cl	327±6.5
Mg$^+$–D	203.6±0.8
Mg$^+$–F	477±50
Mg$^+$–H	190.8±5.8
Mg$^+$–Kr	25.39
Mg$^+$–Mg	125
Mg$^+$–Ne	4.9±0.6
Mg$^+$–O	245.2±10
Mg$^+$–Xe	53.74
Mn$^+$–Cl	>211
Mn$^+$–F	321±24
Mn$^+$–H	202.5±5.9
Mn$^+$–I	>211
Mn$^+$–Mn	129
Mn$^+$–O	285±13
Mn$^+$–S	247±23
Mn$^+$–Se	165±50
Mo$^+$–C	488.2±19
Mo$^+$–F	376±29
Mo$^+$–H	170±6
Mo$^+$–Mo	449.4±1.0
Mo$^+$–O	488.2±1.9
Mo$^+$–S	355.1±5.8
Mo$^+$–Xe	>53.1±6.8
N$^+$–Ar	208.4±9.6
N$^+$–F	584±42
N$^+$–H	≥435.67±0.77
N$^+$–N	843.85±0.10
N$^+$–O	115
Na$^+$–Ar	19±8
Na$^+$–Br	58.2±10.6
Na$^+$–Cl	20.3±10
Na$^+$–He	7.55
Na$^+$–I	64.9±3.0
Na$^+$–Kr	~24.9
Na$^+$–Li	95.8±3.9
Na$^+$–Na	98.64±0.29
Na$^+$–Na	6.4
Na$^+$–Ne	~9.04
Na$^+$–O	37±19
Na$^+$–Xe	~28.6
Nb$^+$–Ar	40.87±0.13
Nb$^+$–C	509±15
Nb$^+$–Fe	>251
Nb$^+$–H	220±7
Nb$^+$–Nb	576.8±9.6
Nb$^+$–O	688±11
Nb$^+$–S	532±10
Nb$^+$–V	404.7±0.2
Nb$^+$–Xe	73.28±0.12
Nd$^+$–Au	267±84
Nd$^+$–Br	352.9
Nd$^+$–Cl	441.4
Nd$^+$–F	309.6
Nd$^+$–I	596±32
Nd$^+$–O	753±15
Ne$^+$–H	1239
Ne$^+$–He	13.0±0.8
Ne$^+$–Ne	125.29±1.93
Ni$^+$–Ar	53.9
Ni$^+$–Br	>289
Ni$^+$–C	418
Ni$^+$–Cl	192±4
Ni$^+$–D	166.0±7.7
Ni$^+$–F	≥456
Ni$^+$–H	158.1±7.7
Ni$^+$–He	12.4±0.4
Ni$^+$–I	>297
Ni$^+$–Ne	9.9±0.4
Ni$^+$–Ni	208
Ni$^+$–O	275.9±7.7
Ni$^+$–S	241.0±3.9
Ni$^+$–Si	326±6.7
Np$^+$–F	730±100
Np$^+$–O	≥752
O$^+$–Ar	33.8
O$^+$–F	301.8±8.4
O$^+$–H	487.9±0.34
O$^+$–N	1050.64±0.13
O$^+$–O	647.75±0.17
Os$^+$–H	238.9
Os$^+$–O	418±50
P$^+$–C	512±42
P$^+$–Cl	289
P$^+$–F	490.6±8.4
P$^+$–H	329.6±2.1
P$^+$–N	483±21
P$^+$–O	791.3±8.4
P$^+$–P	481±50
P$^+$–S	606±34
Pa$^+$–O	~800
Pb$^+$–Br	260±63
Pb$^+$–Cl	285±63
Pb$^+$–F	347±32
Pb$^+$–O	247±8.4
Pb$^+$–Pb	214±29
Pb$^+$–S	293±50
Pb$^+$–Se	169.4±6.3
Pb$^+$–Te	163±63
Pd$^+$–C	528±5
Pd$^+$–H	208.4±8.7
Pd$^+$–O	145±11
Pd$^+$–Pd	197±29
Pd$^+$–S	197±6
Pd$^+$–Si	289±50
Pr$^+$–Au	317±81
Pr$^+$–Br	357.7
Pr$^+$–Cl	445.0
Pr$^+$–F	557±63
Pr$^+$–I	317.0
Pr$^+$–O	796±15
Pt$^+$–Ar	36.4±8.7
Pt$^+$–B	398±105
Pt$^+$–C	530.5±4.8
Pt$^+$–Cl	249.8±14.5
Pt$^+$–H	275±5
Pt$^+$–N	326.9±9.6
Pt$^+$–O	318.4±6.7
Pt$^+$–Pt	318±23
Pt$^+$–Si	515±50
Pt$^+$–Xe	86.6±28.9
Pu$^+$–F	562±50
Pu$^+$–O	655
Rb$^+$–Ar	12.0
Rb$^+$–Br	17.6v5.1
Rb$^+$–Cl	10.5±10.5
Rb$^+$–I	27±42
Rb$^+$–Kr	14.9
Rb$^+$–Na	50.1±3.9
Rb$^+$–Ne	6.95
Rb$^+$–O	29
Rb$^+$–Rb	75.6±9.6
Rb$^+$–Xe	21.5
Re$^+$–C	497.7±3.9
Re$^+$–H	224.7±6.7
Re$^+$–O	435±59
Rh$^+$–C	414±17
Rh$^+$–H	164.8±3.8
Rh$^+$–O	295.0±5.8
Rh$^+$–S	226±13
Ru$^+$–C	453.5±10.6
Ru$^+$–H	160.2±5.0
Ru$^+$–O	372±5
Ru$^+$–S	288±6
S$^+$–C	620.8±1.3
S$^+$–F	343.5±4.8
S$^+$–H	348.2±1.7
S$^+$–N	516±34
S$^+$–O	524.3±0.4

A^+–B	D^o_{298} kJ/mol^{-1}
S$^+$–P	573±21
S$^+$–S	522.4±0.5
Sc$^+$–C	326±6
Sc$^+$–Cl	410±42
Sc$^+$–F	605±32
Sc$^+$–Fe	201±21
Sc$^+$–H	235±8
Sc$^+$–O	689±5
Sc$^+$–S	479.5±4.8
Sc$^+$–Se	475.8±8.4
Sc$^+$–Si	242.3±10.5
Se$^+$–F	364±42
Se$^+$–H	304
Se$^+$–P	514±25
Se$^+$–S	392±19
Se$^+$–Se	413±19
Si$^+$–Au	175±50
Si$^+$–B	351±15
Si$^+$–Br	276±96
Si$^+$–C	365±50
Si$^+$–Cl	591.0±0.6
Si$^+$–F	684.1±5.4
Si$^+$–H	316.6±2.1
Si$^+$–O	478±13.4
Si$^+$–P	272±50
Si$^+$–Pd	237±50
Si$^+$–Pt	525±50
Si$^+$–S	387.5±6.0
Si$^+$–Si	334±19
Si$^+$–Te	347±50
Sm$^+$–Br	343.3
Sm$^+$–Cl	435.4
Sm$^+$–F	620.9
Sm$^+$–I	299.1
Sm$^+$–O	569±15
Sn$^+$–Br	335±50
Sn$^+$–Cu	184±96
Sn$^+$–F	364±29

A^+–B	D^o_{298} kJ/mol^{-1}
Sn$^+$–O	281±10
Sn$^+$–S	240±19
Sn$^+$–Se	174±6.3
Sn$^+$–Sn	193
Sn$^+$–Te	168.7±8.4
Sr$^+$–Ar	13.32±2.92
Sr$^+$–Br	378.1±8.4
Sr$^+$–Cl	427±8.4
Sr$^+$–F	615±50
Sr$^+$–H	209±5
Sr$^+$–I	308.2
Sr$^+$–Kr	18.13±6.94
Sr$^+$–Ne	4.52±9.6
Sr$^+$–O	298.7
Sr$^+$–Sr	105.2±1.6
Ta$^+$–H	230±6
Ta$^+$–O	787±63
Ta$^+$–$^-$Ta	666
Tb$^+$–Cu	245±34
Tb$^+$–O	722±15
Tc$^+$–H	197.5
Tc$^+$–O	>167
Te$^+$–H	305±12
Te$^+$–O	339±50
Te$^+$–P	415±97
Te$^+$–Se	342±19
Te$^+$–Te	278±29
Th$^+$–Cl	499±29
Th$^+$–F	682±29
Th$^+$–O	875±16
Th$^+$–Pt	388±193
Th$^+$–Rh	504±67
Ti$^+$–C	395±23
Ti$^+$–Cl	426.8
Ti$^+$–F	≥456
Ti$^+$–H	226.6±10.6
Ti$^+$–N	501±13
Ti$^+$–O	667±7

A^+–B	D^o_{298} kJ/mol^{-1}
Ti$^+$–Pt	82±96
Ti$^+$–S	461.1±6.8
Ti$^+$–Si	249±16
Ti$^+$–Ti	229
Tl$^+$–Br	52±50
Tl$^+$–Cl	26±4
Tl$^+$–F	13±21
Tl$^+$–I	133±21
Tl$^+$–Tl	22±50
Tm$^+$–Br	312.2
Tm$^+$–Cl	407.9
Tm$^+$–F	537±16
Tm$^+$–I	266.8
Tm$^+$–O	482±15
U$^+$–Br	345±29
U$^+$–C	300±96
U$^+$–Cl	431±34
U$^+$–D	283.4±9.6
U$^+$–F	668±29
U$^+$–H	284±8
U$^+$–N	~485
U$^+$–O	757±42
U$^+$–P	186
U$^+$–S	518±29
V$^+$–Ar	39.39±0.12
V$^+$–C	373±13.5
V$^+$–D	202±6
V$^+$–Fe	314±21
V$^+$–H	202±6
V$^+$–Kr	49.46±0.18
V$^+$–N	448.6±5.8
V$^+$–Nb	403.5±0.2
V$^+$–O	581.6±9.6
V$^+$–S	358.9±8.7
V$^+$–Si	229±15
V$^+$–V	302
V$^+$–Xe	66.4±0.6
W$^+$–C	483±21

A^+–B	D^o_{298} kJ/mol^{-1}
W$^+$–F	444±96
W$^+$–H	222.5±5
W$^+$–O	695±42
Xe$^+$–Ar	13.4
Xe$^+$–H	355
Xe$^+$–Kr	41.65±0.08
Xe$^+$–N	62.7±9.6
Xe$^+$–Ne	2.1±0.8
Xe$^+$–Xe	99.6
Y$^+$–C	281±12
Y$^+$–F	677±21
Y$^+$–H	260.5±5.8
Y$^+$–O	718±25
Y$^+$–Pt	466±192
Y$^+$–S	533.9±8
Y$^+$–Si	243±13
Y$^+$–Te	360±96
Y$^+$–Y	281±21
Yb$^+$–Br	307.4
Yb$^+$–Cl	399.6
Yb$^+$–F	557.5±14.4
Yb$^+$–I	262.0
Yb$^+$–O	376±15
Yb$^+$–Yb	238±96
Zn$^+$–Ar	28.7±1.2
Zn$^+$–H	216±15
Zn$^+$–O	161.1±4.8
Zn$^+$–S	198±12
Zn$^+$–Si	274.1±9.6
Zn$^+$–Zn	60±19
Zr$^+$–Ar	36.09±0.24
Zr$^+$–C	445.8±15.4
Zr$^+$–H	218.8±9.6
Zr$^+$–N	443±46
Zr$^+$–O	753±11
Zr$^+$–S	533±21
Zr$^+$–Zr	407.0±9.6

TABLE 7. Bond Dissociation Energies in Polyatomic Cations

This Table has been arranged on the basis of the Periodic Table with the IUPAC notation for Groups 1 to 18, see inside front cover of this *Handbook*. The **boldface** in the species indicates the dissociated fragment.

Reference

Luo, Y.-R. *Comprehensive Handbook of Chemical Bond Energies*, Taylor & Francis, 2006.

Bond	D^o_{298}/ kJ mol^{-1}
(1) Group 1	
Li$^+$–H_2	27.2
Li$^+$–CO	57±13
Li$^+$–H_2O	139±8
Li$^+$–NH_3	156±8
Li$^+$–CH_4	130
Li$^+$–CH_3OH	156±8
Li$^+$–CH_3OCH_3	167±10
Li$^+$–pyridine	183.0±14.5
Li$^+$–Gly (glycine)	220±9
Na$^+$–H_2	10.4±0.8
Na$^+$–N_2	33.5
Na$^+$–CO	31±8
Na$^+$–CO_2	66.5
Na$^+$–SO_2	79.1
Na$^+$–O_3	52.3
Na$^+$–H_2O	91.2±6.3
Na$^+$(H$_2$O)–H_2O	82.0±5.8
Na$^+$(H$_2$O)$_2$–H_2O	66.1
Na$^+$(H$_2$O)$_3$–H_2O	52.7±0.8
Na$^+$(glycine)–H_2O	75.1±5.3
Na$^+$(glutamine)–H_2O	52±1
Na$^+$–NH_3	106.2±5.4
Na$^+$–HNO_3	86.2
Na$^+$–CH_4	30.1
Na$^+$–CH_3OH	98.8±5.7
Na$^+$–CH_3CN	125.5±9.6
Na$^+$–C_2H_4	44.6±4.4
Na$^+$–CH_3OCH_3	101.4±5.7
Na$^+$–$CH_3C(O)H$	114.4±3.4
Na$^+$– MeCOMe	131.3±4.1
Na$^+$–C_6H_6	97.0±5.9
Na$^+$–pyrrole	103.7±4.8
Na$^+$ –Gly (glycine)	166.7±5.1
Na$^+$ –Ala (alanine)	167±4
Na$^+$–GlyGly (glycylglycine)	203±8
K$^+$–H_2	6.1±0.8
K$^+$–CO_2	35.6
K$^+$–H_2O	74.9
K$^+$(H$_2$O)$_2$–H_2O	67.4
K$^+$(H$_2$O)$_3$–H_2O	55.2
K$^+$(H$_2$O)$_4$–H_2O	11.8
K$^+$(H$_2$O)$_5$–H_2O	44.8
K$^+$(H$_2$O)$_6$–H_2O	41.8
K$^+$–NH_3	79±7
K$^+$–C_6H_6	80.3
K$^+$–adenine	95.1±3.2
K$^+$–indole	104.6±12.6
K$^+$–Phe (phenylalanine)	150.5±5.8
K$^+$–Tyr (tyrosine)	165.0±5.8
Rb$^+$–H_2O	66.9±12.6
Rb$^+$–NH_3	78.2
Rb$^+$–CH_3CN	86.6±1.3
Rb$^+$–C_6H_5OH	70.2±3.7
Cs$^+$–H_2O	57.3
Cs$^+$–$C_6H_5NH_2$	70.8±4.5
(2) Group 2	
CH_3Be^+–CH_3	192.9±13.4
***tert*-C(CH$_3$)$_3$Be$^+$**–*tert*-C(CH$_3$)$_3$	121.8±13.4
Mg$^+$–OH	314±33
Mg$^+$–CO	43.1±5.8
Mg$^+$–CO_2	58.4±5.8
Mg$^+$–H_2O	122.5±12.5
Mg$^+$–NH_3	158.9±11.6
Mg$^+$–CH_4	29.8±6.8
Mg$^+$–MeOH	147.6±6.8
Mg$^+$–C_6H_6	155.2
Mg$^+$–pyridine	200.0±6.4
Mg$^+$–imidazole	243.9±10.4
Mg^{2+}(H$_2$O)$_5$–H_2O	101.3
Mg^{2+}(Me$_2$CO)$_5$–Me_2CO	93.3
Ca$^+$–OH	435.1±14.5
Ca$^+$–H_2O	117.2
Ca$^+$–C_6H_6	134
Ca$^+$–imidazole	186.3±3.9
Ca^{2+}(H$_2$O)$_4$–H_2O	110.0±5.9
Ca^{2+}(Me$_2$CO)$_5$–Me_2CO	101.3
Sr$^+$–CO	20.3
Sr$^+$–CO_2	41.9
Sr$^+$–H_2O	144.3
Sr$^+$–C_6H_6	117
Sr^{2+}(H$_2$O)$_5$–H_2O	87.4
Ba$^+$–OH	530.7±19.3
Ba^{2+}(H$_2$O)$_4$–H_2O	90.8
(3) Group 3	
Sc$^+$–H_2	23.0±1.3
Sc$^+$–CH_2	412±22
Sc$^+$–CH_3	233±10
Sc$^+$–C_2H_2	240±20
Sc$^+$–C_2H_4	≥131
Sc$^+$–C_6H_6	222±21
Sc$^+$–H_2O	131
Sc$^+$–NH	483±10
Sc$^+$–NH_2	347±5
Sc$^+$–pyridine	231.5±10.3
Y$^+$–CH_2	398±13
Y$^+$–CH_3	249±5.0
Y$^+$–C_2H_2	218±13
Y$^+$–C_2H_4	>138
Y$^+$–CO	29.9±10.6
Y$^+$(O)–CO_2	86±5
La$^+$–CH	523±33
La$^+$–CH_2	401±7
La$^+$–CH_3	217±15
La$^+$–C_2H_2	262±30
La$^+$–C_2H_4	192.5
Lu$^+$–CH_2	>230±6
Lu$^+$–CH_3	176±20
U$^+$(F)–F	552±44
U$^+$(F)$_2$–F	523±38
U$^+$(F)$_3$–F	381±19
U$^+$(F)$_4$–F	243±17
U$^+$(F)$_5$–F	26±11
(4) Group 4	
Ti$^+$–CH	478±5
Ti$^+$–CH_2	391±15
Ti$^+$–CH_3	213.8±3
Ti$^+$–CH_4	70.3±2.5
Ti$^+$–C_2H_2	213±13
Ti$^+$–C_2H_4	146±11
Ti$^+$–C_6H_6	259±9
Ti$^+$–CO	117.7±5.8
Ti$^+$–H_2O	157.7±5.9
Ti$^+$–NH	466±12
Ti$^+$–NH_2	356±13
Ti$^+$–NH_3	197±7
Ti$^+$–pyridine	217.2±9.3

Bond	D^o_{298}/ kJ mol^{-1}
Ti$^+$–imidazole	≤232.4±8.2
Zr$^+$–CH	568±13
Zr$^+$–CH_2	444.8±5
Zr$^+$–CH_3	227.7±9.6
Zr$^+$–C_2H_2	273±14
Zr$^+$–CO	77±10
Zr$^+$–CS	242±11
Hf$^+$–CH_2	427±38
Hf$^+$–C_2H_2	150.6
(5) Group 5	
(CO)$_6$V$^+$–H	220±14
V$^+$–H_2	42.7±2.1
V$^+$–CH	470±5
V$^+$–CH_2	326±6
V$^+$–CH_3	193±7
V$^+$–C_2H_2	172±8
V$^+$–C_2H_4	124±8
V$^+$–(η^5-C_5H_5)	530.7
V$^+$–C_6H_6	234±10
V$^+$–CO	114.8±2.9
V$^+$–CO_2	72.4±3.8
V$^+$–H_2O	149.8±5.0
V$^+$–NH	423±29
V$^+$–NH_2	293±6
V$^+$–NH_3	192±11
V$^+$–pyridine	218.7±13.5
V$^+$–imidazole	≤243.4±8.0
Nb$^+$–H_2	61.9
Nb$^+$–CH	581±19
Nb$^+$–CH_2	428.4±8.7
Nb$^+$–CH_3	198.8±10.6
Nb$^+$–CH_3NH_2	134
Nb$^+$–C_3H_6	117.7
(NbFe)$^+$–C_3H_4	>163
Nb$^+$–CO	95.5±4.8
Nb$^+$–CS	242±11
Nb$_7$ $^+$–N_2	<215
Ta$^+$–CH	575±9
Ta$^+$–CH_2	485±5
Ta$^+$–CH_3	196±3
Ta$^+$–C_6H_6	251~301
(6) Group 6	
(CO)$_6$Cr$^+$–H	230±10
(η^5-**C$_5$H$_5$**)**(NO)(CO)$_2$Cr**$^+$–H	207.1±14
Cr$^+$–H_2	31.8±2.1
Cr$^+$–CH	294±29
Cr$^+$–CH_2	216±4
Cr$^+$–CH_3	110±4
Cr$^+$–C_6H_6	170±10
Cr$^+$–indole	196.6±16.7
Cr$^+$–CO	89.7±5.8
Cr$^+$–OH	298±14
Cr$^+$–H_2O	132.6±8.8
Cr$^+$–N_2	59±4
Cr$^+$–NH_3	183±10
(CO)$_6$Mo$^+$–H	260±9
Mo$^+$–CH	509±10
Mo$^+$–CH_2	329±12
Mo$^+$–CH_3	157±12
Mo$^+$–CO	193.9±9.6
Mo$^+$–CO_2	49.2±7
Mo$^+$–CS	162±18
Mo$^+$–CS_2	67.5±12.5
Mo$^+$–NH	<385
Mo$^+$–pyrrole	>289
(CO)$_6$W$^+$–H	257±9
W$^+$–CH	580±27
W$^+$–CH_2	456.4±5.8
W$^+$–CH_3	~222.9±9.6
(PMe$_3$)$_3$(CO)$_3$W$^+$–H	259.4
W$^+$–pyrrole	>209
(7) Group 7	
(CO)$_5$Mn$^+$–H	172±10
Mn$^+$–H_2	7.9±1.7
Mn$^+$–CH_2	295±13
Mn$^+$–CH_3	215±10
Mn$^+$**(CO)$_5$**–CH_3	132±15
Mn$^+$**(CO)$_5$**–CH_4	>30
Mn$^+$–(η^5-C_5H_5)	326.1±9.6
Mn$^+$–C_6H_6	145±10
Mn$^+$–OH	332±24
Mn$^+$–CO	25±10
Mn$^+$–H_2O	121.8±5.9
Mn$^+$–CH_3OH	134±29
Mn$^+$–$OC(CH_3)_2$	159±14
Mn$^+$–CS	80.0±21
Mn$^+$–NH_2	254±20
Mn$^+$–NH_3	147±8
Tc$^+$–CH_2	<464
Tc$^+$–C_2H_2	<320
Re$^+$**(CH$_3$)(CO)$_5$**–H	294±13
(PMe$_3$)(CO)$_2$Re$^+$–H	300.4
(8) Group 8	
Fe$^+$**(O)**–H	444±17
Fe$^+$**(CO)**–H	120±23
Fe$^+$**(H$_2$O)**–H	215±14
Fe$^+$(η^5-**C$_5$H$_5$**)–H	193±21
(CO$_2$)$_5$Fe$^+$–H	299±15
Fe$^+$–H_2	45.2±2.5
Fe$^+$–CH	423±29
Fe$^+$–CH_2	≤342±2
Fe$^+$–CH_3	229±5
Fe$^+$–CH_4	73.2
Fe$^+$–C_2H_2	159.0±2.1
Fe$^+$–C_2H_3	238±10
Fe$^+$–C_2H_4	145±11
Fe$^+$–C_2H_5	233±9
Fe$^+$–C_2H_6	64±6
Fe$^+$–OH	366±12
Fe$^+$–CO	129.3±3.9
Fe$^+$**D**–CO	53±13
Fe$^+$–CO_2	74.3±7.7
Fe$^+$–H_2O	128.9±0.8
Fe$^+$–N_2	53±4
Fe$^+$–NH_3	184±12
Fe$^+$–CS_2	166.1±4.6
Fe$^+$–imidazole	246.1±13.8
Fe$^+$–SiH	254±13
Fe$^+$–SiH_2	181±9
Fe$^+$–SiH_3	183±9
Ru$^+$(η^5-**C$_5$H$_5$**)$_2$–H	292±16
(η^5-**C$_5$Me$_5$**)$_2$**Ru**$^+$–H	284.5
Ru$^+$–CH	501.7±11.6
Ru$^+$–CH_2	344.4±4.8
Ru$^+$–CH_3	160.2±5.8
Ru$^+$–CS	253±20
OsO$_4$ $^+$–H	552±13
(9) Group 9	
(η^5-**C$_5$H$_5$**)**(CO)$_2$Co**$^+$–H	245±12
(CH$_3$OD)Co$^+$–H	147.6±7.7
Co$^+$–H_2	76.1±4.2
(η^5-**C$_5$H$_5$**)**Co**$^+$–H_2	67.8
Co$^+$–CH	420±37
Co$^+$–CH_2	317±5
Co$^+$–CH_3	203±4
Co$^+$–CH_4	96.7
Co$^+$–C_{60}	243±67
Co$^+$–CO	173.7±6.7
Co$^+$–H_2O	164.4±5.9
Co$^+$–CS	259±33
Co$^+$–N_2	96.2±7.1
Co$^+$–NH_2	247±7
Co$^+$–NH_3	219±16
Co$^+$–CH_3CN	>255±17

Bond	D^o_{298}/ kJ mol^{-1}
Co$^+$–P(CH$_3$)$_3$	278±11
Co$^+$–P(C$_2$H$_5$)$_3$	339±16
(CH)Rh$^+$–H	372±21
(η^5-**C$_5$H$_5$**)(**CO**)$_2$**Rh**$^+$–H	287±12
Rh$^+$–CH	444±12
Rh$^+$–CH$_2$	356±8
Rh$^+$–CH$_3$	142±6
Rh$^+$–NO	167±21
Rh$^+$–CS	234±19
(**CO**)(η^5-**C$_5$H$_5$**)(**PPh$_3$**)**Ir**$^+$–H	313.4
(**CO**)$_2$(η^5-**C$_5$Me$_5$**)**Ir**$^+$–H	298.3
Ir$^+$–CH$_2$	>464
Ir$^+$–C$_2$H$_4$	234.3
(10) Group 10	
(**CO**)$_4$**Ni**$^+$–H	248±9
(η^5-**C$_5$H$_5$**)(**NO**)**Ni**$^+$–H	315±14
(η^5-**C$_5$H$_5$**)(η^5-**C$_5$H$_5$**)**Ni**$^+$–H	215±13
Ni$^+$–H$_2$	72.4±1.3
Ni$^+$–CH	301.0±11.6
Ni$^+$–CH$_2$	306±4
Ni$^+$–CH$_3$	169.8±6.8
Ni$^+$–CH$_4$	96.5±4
Ni$^+$–OH	235±19
Ni$^+$–CO	175±11
Ni$^+$–CO$_2$	104±1
Ni$^+$–H$_2$O	183.7±3.3
Ni$^+$–CS	234.5±9.6
Ni$^+$–N$_2$	110.9±10.5
Ni$^+$–NO	227.6±7.5
Ni$^+$–NH$_2$	232.5±7.7
Ni$^+$–NH$_3$	238±19
Pd$^+$–CH	536±10
Pd$^+$–CH$_2$	463±3
Pd$^+$–CH$_3$	258±8
Pd$^+$–CH$_4$	170.8±7.7
Pd$^+$–CS	200±14
Pd$^+$–C$_2$H$_2$	>28.9±4.8
Pt$^+$–H$_2$	146.7±11.6
Pt$^+$–CH	536.4±9.6
Pt$^+$–CH$_2$	471
Pt$^+$–CH$_3$	257.6±7.7
Pt$^+$–CH$_4$	170.8±7.7
Pt$^+$–O$_2$	64.6±4.8
Pt$^+$–CO	218.1±8.7
Pt$^+$–CO$_2$	59.8±4.8
Pt$^+$–NH$_3$	274±12
Pt$^+$–C$_2$H$_4$	229.7

Bond	D^o_{298}/ kJ mol^{-1}
(11) Group 11	
Cu$^+$–H$_2$	51.9±0.4
Cu$^+$–CH$_2$	267.3±6.8
Cu$^+$–CH$_3$	111±7
Cu$^+$–C$_2$H$_2$	>21.2±9.6
Cu$^+$–C$_2$H$_4$	176±14
Cu$^+$–C$_6$H$_6$	218.0±9.6
Cu$^+$–CO	149±7
Cu$^+$–N$_2$	89±30
Cu$^+$–NO	109.0±4.8
Cu$^+$–H$_2$O	160.7±7.5
Cu$^+$–NH$_2$	192±13
Cu$^+$–NH$_3$	237±15
Cu$^+$–CS	238.3±11.6
Cu$^+$–SiH	246±27
Cu$^+$–SiH$_2$	≥231±7
Cu$^+$–SiH$_3$	97±25
Ag$^+$–CH$_2$	≥107±4
Ag$^+$–CH$_3$	66.6±4.8
Ag$^+$–C$_2$H$_5$	65.7±7.5
Ag$^+$–C$_6$H$_6$	167±19
Ag$^+$–O$_2$	29.7±0.8
Ag$^+$–CO	89±5
Ag$^+$–H$_2$O	134±8
Ag$^+$–CS	152±20
Ag$^+$–NH$_3$	170±13
Au$^+$–CH$_2$	≤372±3
Au$^+$–C$_2$H$_4$	344.5
Au$^+$–C$_6$H$_6$	289±29
Au$^+$–CO	201±8
Au$^+$–H$_2$O	164.0±9.6
Au$^+$–H$_2$S	230±25
Au$^+$–NH$_3$	297±29
Au$^+$–PH$_3$	402±33
(12) Group 12	
Zn$^+$–H$_2$	15.7±1.7
Zn$^+$–CH$_3$	280±7
Zn$^+$–OH	127.2
Zn$^+$–H$_2$O	163
Zn$^+$–NO	76.2±9.6
Zn$^+$–pyrimidine	209.6±7.7
Zn$^+$–CS	149±23
Cd$^+$–CH$_3$	228±3
Cd$^+$(**CH$_3$**)–CH$_3$	109±3
Cd$^+$–C$_6$H$_6$	136±19
Hg$^+$–CH$_3$	285±3
Hg$^+$(**CH$_3$**)–CH$_3$	96±3

Bond	D^o_{298}/ kJ mol^{-1}
(13) Group 13	
B$^+$–H$_2$	15.9±0.8
HB$^+$–H$_2$	61.5±2.1
(**CH$_3$**)$_2$**B**$^+$–CH$_3$	32.6±4.2
Al$^+$–H$_2$	5.6±0.6
Al$^+$–N$_2$	5.6
Al$^+$–CO$_2$	≥29.3
Al$^+$–H$_2$O	104±15
Al$^+$–MeOH	139.7
Al$^+$–EtC(O)Et	191.2
Al$^+$–C$_6$H$_6$	147.3±8.4
Al$^+$–pyridine	190.3±10.3
Al$^+$–phenol	154.8±16.7
Al$^+$–imidazole	232.4±8.2
Ga$^+$–NH$_3$	122.5
In$^+$–NH$_3$	111.0
(14) Group 14	
C$_{58}$ $^+$–C$_2$	955±15
C$_{60}$ $^+$–C$_2$	822.0±12.5
C$_{62}$ $^+$–C$_2$	846.2±10.6
C$_{78}$ $^+$–C$_2$	938.8±10.6
HC$_2$ $^+$–H	574.749
C$_6$H$_5$ $^+$–H	376.3±4.8
C$_2$H$_3$ $^+$–Cl	247±4.8
C$_2$H$_5$ $^+$–Br	126.4
C$_6$H$_5$ $^+$–Br	266.3
CH$_3$ $^+$–H$_2$	186
CH$_5$ $^+$–H$_2$	7.9±0.4
C$_2$H$_5$ $^+$–H$_2$	17
CO$^+$–N$_2$	67.5±19.3
H$_2$CH$^+$–N$_2$	31.8
CO$^+$–CO	173.7±14.6
CO$^+$(**CO**)–CO	52.3
CO$^+$(**CO**)$_2$–CO	30.2
CO$^+$(**CO**)$_3$–CO	18.4
(**CO$_2$**)$^+$–CO$_2$	70.3
(**CO$_2$**)$^+$(**CO$_2$**)–CO$_2$	34.7
(**CO$_2$**)$^+$(**CO$_2$**)$_2$–CO$_2$	21.3
(**CO$_2$**)$^+$(**CO$_2$**)$_3$–CO$_2$	20.1±1.3
CH$_3$ $^+$–N$_2$O	221.3
CH$_3$ $^+$–SO$_2$	253.6
CH$_3$ $^+$–OCS	239.3
CH$_3$ $^+$–CS$_2$	251.9
CH$_3$ $^+$–H$_2$O	279
CH$_3$ $^+$(**H$_2$O**)–H$_2$O	106.3
CH$_3$ $^+$(**H$_2$O**)$_2$–H$_2$O	87.9
CH$_3$ $^+$(**H$_2$O**)$_3$–H$_2$O	61.9
CH$_3$ $^+$(**H$_2$O**)$_4$–H$_2$O	48.5

Bond	D^o_{298}/ kJ mol^{-1}
CH_3^+–H_2S	344.8
CH_2^+–CH_2O	303.0±2.9
CH_3^+–NH_3	431.4
$(CH_3)^+$–CH_3	209.2±4.2
CH_3^+–CH_4	166.5
CF_3^+–CH_4	19.0
$(CH_5)^+$–CH_4	28.7±1.3
$C_6H_6^+$–CH_4	12.0
CH_3^+–CH_3F	230
CH_3^+–CF_3Cl	221
CH_3^+–CH_3Cl	259
tert-$C_4H_9^+$–CH_3OH	63
tert-$C_4H_9^+$–CH_3CN	85
tert-$C_4H_9^+$–SO_2F_2	43.5
CH_3^+–C_2H_3O	338.7±2.9
CH_3^+–CF_3ClOCl	252
tert-$C_4H_9^+$–$(CH_3)_2S$	185
tert-$C_4H_9^+$–C_2H_5OH	85
tert-$C_4H_9^+$–C_3H_8	27.6
tert-$C_4H_9^+$–t-C_4H_9Cl	339
tert-$C_4H_9^+$–$(CH_3)_3CH$	30.1
tert-$C_4H_9^+$–C_6H_6	92
$(C_6H_6)^+$–C_6H_6	73.6
$(C_6H_6)^+$–indole	54.8
$C_6F_6^+$–C_6F_6	30.1±4
C_{60}^+–C_{60}	35.89±7.72
$PhSiH_2^+$–H	159
$Si^+(CH_3)_3$–Cl	178.5±1.9
SiH_3^+–CO	≥151
SiF_3^+–CO	174.1±1.3
$(CH_3)_3Si^+$–H_2O	125.9±7.9
$(CH_3)_3Si^+$–NH_3	194.6
$Si^+(CH_3)(Cl)_2$–CH_3	60.8±2.9
$Si^+(CH_3)_2(Cl)$–CH_3	41.5±1.9
Si^+–CH_3	413.9±5.8
$Si^+(CH_3)$–CH_3	123±48
$Si^+(CH_3)_2$–CH_3	513±27
$Si^+(CH_3)_3$–CH_3	66.6±5.8
$(CH_3)_3Si^+$–CH_3OH	164.0
$(CH_3)_3Si^+$–$(C_2H_5)_2O$	184.9
$(CH_3)_3Si^+$–C_6H_6	100.0
$(CH_3)_3Si^+$–CH_3NH_2	231.8
$(CH_3)_3Ge^+$–H_2O	119.7±2.1
$(C_2H_5)_3Ge^+$–H_2O	104.2±2.1
$(CH_3)_3Sn^+$–NH_3	154
$(CH_3)_3Sn^+$–H_2O	108
$(CH_3)_3Sn^+$–$(CH_3)_2CO$	157
$(CH_3)_3Sn^+$–C_3H_7SH	143
Pb^+–H_2O	93.7
Pb^+–NH_3	118.4±0.8
Pb^+–CH_3OH	97.5±0.8
Pb^+–CH_3NH_2	148.1 ±1.3
Pb^+–C_6H_6	110±2
(15) Group 15	
H_2N^+–H	544.43±0.10
H_3N^+–H	515.1
Me_3N^+–H	376
Et_3N^+–H	362
(imidazole)$^+$ –Zn	216.1±3.9
N_2H^+–H_2	24.7±0.8
ON^+–O_2	14.2
N^+–N_2	303.8
ON^+–N_2	21.3
N_2^+–N_2	102.3±14.6
HN_2^+–N_2	60.7
N_3^+–N_2	18.8±1.3
O_2N^+–N_2	19.2±1.3
H_4N^+–N_2	54±21
ON^+–NO	59.4±0.8
ON^+–CO	27.2±1.3
ON^+–O_3	<58
ON^+–CO_2	32.2
N_2O^+–ON_2	72.8±6.3
NO^+–ON_2	36.4±0.8
$(HON_2)^+$–ON_2	69.9±4
ON^+–H_2O	95
$ON^+(H_2O)$–H_2O	67.4
$ON^+(H_2O)_2$–H_2O	56.5
H_4N^+–H_2O	86.2±4.2
$H_4N^+(H_2O)$–H_2O	72.8±4.2
$H_4N^+(H_2O)_2$–H_2O	57.3±4.2
$H_4N^+(H_2O)_3$–H_2O	51.0
$H_4N^+(H_2O)_4$–H_2O	44.4
(glycine)H^+–H_2O	77.2±11.0
(tryptophan)H^+–H_2O	31.2±2.5
(tryptophanylglicine)H^+–H_2O	56.0±5.3
H_4N^+–H_2S	47.7
$H^+(NH_3)$–NH_3	108.8
$H^+(NH_3)_2$–NH_3	69.5
$H^+(NH_3)_3$–NH_3	57.3
$H^+(NH_3)_4$–NH_3	49.0
$H^+(NH_3)_5$–NH_3	29.3
$H^+(NH_3)_6$–NH_3	27.2
NH_4^+–CH_4	15.0
ON^+–CH_3OH	97.6
O_2N^+–CH_3OH	80.3±9.6
(CH_3CNH)$^+$–CH_3CN	130.1±9.6
(pyridineH)$^+$–pyridine	105.4±4
(valine H)$^+$–valine	86.6±8.4
(betainH)$^+$–betaine	139.9±4.8
H_4P^+–H_2O	54.4
$(H_4P)^+$–PH_3	48.1
AsH_2^+–H	257
I_2As^+–acetone	106±17
I_2As^+–benzene	77±17
Bi^+–H_2O	95.4
Bi^+–NH_3	149
Bi^+–C_6H_6	≤149
(16) Group 16	
$(H_3O)^+$–H_2	14.6±2.1
O^+–O_2	179.5
$O^+(O_2)_1$–O_2	28.9
$O^+(O_2)_2$–O_2	3.9
O_2^+–O_2	38.3±2.1
$O_2^+(O_2)$–O_2	24.6±1.3
$O_2^+(O_2)_2$–O_2	10.4±0.8
$O_2^+(O_2)_3$–O_2	9.0±0.8
$O_2^+(O_2)_4$–O_2	8.0±0.8
$O_2^+(O_2)_5$–O_2	7.9±1.3
O^+–N_2	231.4
O_2^+–N_2	22.6
$(H_3O)^+$–N_2	22.2±2.1
O_4^+–N_2	12.3
O_2^+–CO	31.8
O_2^+–CO_2	41.0±2.1
CO_2^+–CO_2	65.3±4
$(H_3O)^+$–CO_2	64.0
$(H_3O)^+(CO_2)$–CO_2	51.9
$(H_3O)^+(CO_2)_2$–CO_2	43.9
$(H_3O)^+(CO_2)_3$–CO_2	18.0
O_2^+–ON_2	56.1±4
$(H_3O)^+$–ON_2	70.7±6.5
$(H_3O)^+(H_2O)$–ON_2	50.6±2.1
$(H_3O)^+(H_2O)_2$–ON_2	42.7±2.1
O_3^+–O_3	67.5±39
$OClO^+$–OClO	246±48
O_2^+–H_2O	>67
$(OH)^+(H_2O)_2$–H_2O	87.4
$(OH)^+(H_2SO_4)(H_2O)_4$–H_2O	56.9
$(OH)^+(H_2SO_4)(H_2O)_5$–H_2O	49.8
$(OH)^+(H_2SO_4)(H_2O)_6$–H_2O	44.8
$(H_2O)^+$–H_2O	164.0
$(H_3O)^+$–H_2O	140.2
$(H_3O)^+(H_2O)$–H_2O	93.3
$(H_3O)^+(H_2O)_2$–H_2O	71.1
$(H_3O)^+(H_2O)_3$–H_2O	64.0
$(H_3O)^+(H_2O)_4$–H_2O	54.4

Bond	D^o_{298}/ kJ mol^{-1}
$(H_3O)^+(H_2O)_5$–H_2O	49.0
$(H_3O)^+(H_2O)_6$–H_2O	43.1
$(HCOOH)H^+$–H_2O	100.8
$CH_3OH_2^+$–H_2O	115.6
CH_3CHOH^+–H_2O	104.6
$(CH_3)_2OH^+$–H_2O	100.4
(tetrahydrofuranH)$^+$–H_2O	82.8
(furanH)$^+$–H_2O	43.5
furane$^+$–H_2O	41.0
(phenol)$^+$–H_2O	78.0
(1-naphthol)$^+$–H_2O	66.4
H_3O^+–HC(O)H	137.7
H_3O^+–NH_3	229.3
$H_3O^+(NH_3)$–NH_3	77.0
$H_3O^+(NH_3)_2$–NH_3	71.5
$H_3O^+(NH_3)_3$–NH_3	62.8
H_3O^+–PH_3	144
H_3O^+–SO_3	74
(HCOOH)$^+$–HCOOH	96.5±9.6
H_3O^+–CH_4	33.5
$(CH_3OH)^+$–CH_3OH	115.8±19.3
$CH_3OH_2^+$–CH_3OH	136.4
H_3O^+–CH_3CN	195.4
furan$^+$–furan	94.1
BH$^+$–B, B = tetrahydofuran	125.1

Bond	D^o_{298}/ kJ mol^{-1}
S^+–CS_2	166
CS^+–CS_2	150.6
CS_2^+–CS_2	104.2
HCS_2^+–CS_2	46.4
OS^+–SO_2	57.7
O_2S^+–SO_2	63.6
OCS^+–OCS	100.0
OCS^+–CO_2	72.0
SO_2^+–CO_2	42.7
H_3S^+–H_2O	91.6
thiopheneH$^+$–H_2O	42.7
H_3S^+–H_2S	53.6±6.3
H_3S^+–CH_4	16.3
$(CH_3)_2Se^{\bullet+}$–$Se(CH_3)_2$	~95±3
$(CH_3)_2Te^{\bullet+}$–$Te(CH_3)_2$	97±2
(17) Group 17	
HF^+–HF	≥138
$(H_2Cl)^+$ –Cl	39.6
HCl^+–HCl	83.9
Cl^+–CCl_3	446.7±9.6
Cl^+–C_2H_3	685.0±4.8
HBr^+–HBr	96
I^+–CH_3	330.0
$I^+(CH_3I)$–CH_3	51.1

Bond	D^o_{298}/ kJ mol^{-1}
$I^+(CH_3I)_2$–CH_3	112.9
(18) Group 18	
$He^+(He)_1$–He	17.6
$He^+(He)_2$–He	2.7±0.6
$Ne^+(Ne)$–Ne	10.3±0.6
$Ne^+(Ne)_2$–Ne	3.3±0.6
$Ar^+(Ar)$–Ar	20.4±0.6
$Ar^+(Ar)_2$–Ar	7.0±0.6
$Ar^+(N_2)$–Ar	25.1
$Ar^+(N_2)(Ar)$–Ar	7.1
$Ar^+(N_2)(Ar)_2$–Ar	7.1
$Kr^+(Kr)$–Kr	23.3±0.6
$Kr^+(Kr)_2$–Kr	9.0±0.6
$Xe^+(Xe)$–Xe	25.2±0.6
$Xe^+(Xe)_2$–Xe	11.0±0.6
Ar^+–H_2	93.7
Ar^+–N_2	127.6
$Ar^+(N_2)$–N_2	31.0
$Ar^+(N_2)_2$–N_2	10.9
Ar^+–CO	75±17
$Ar^+(CO)$–CO	13
Kr^+–CO	103.3±7.5
Kr^+–CO_2	79.1±2.9