2-Butene, (Z)-

Other names:	(2Z)-2-Butene
	(Z)-2-BUTENE
	(Z)-2-C4H8
	(Z)-but-2-ene
	2-Butene, (2Z)-
	2-Butene, cis-
	Butene-2, cis-
	CIS-1,2-DIMETHYLETHYLENE
	CIS-2-BUTENE
	CIS-BUTYLENE
	cis-2-Butylene
	cis-Butene
Inchi:	InChI=1S/C4H8/c1-3-4-2/h3-4H,1-2H3/b4-3-
InchiKey:	IAQRGUVFOMOMEM-ARJAWSKDSA-N
Formula:	C4H8
SMILES:	CC=CC
Mol. weight [g/mol]:	56.11
CAS:	590-18-1

Physical Properties

Property code	Value	Unit	Source
af	0.2020		KDB
chg	-2709.80 ± 1.20	kJ/mol	NIST Webbook
dm	0.30	debye	KDB
gf	65.90	kJ/mol	KDB
hcg	2687.84	kJ/mol	KDB
hcn	2511.781	kJ/mol	KDB
hf	-7.70 ± 1.30	kJ/mol	NIST Webbook
hf	-6.99	kJ/mol	KDB
hfus	6.32	kJ/mol	Joback Method
hvap	22.10	kJ/mol	NIST Webbook
hvap	22.70	kJ/mol	NIST Webbook
ie	9.12 ± 0.02	eV	NIST Webbook
ie	9.07	eV	NIST Webbook
ie	9.12	eV	NIST Webbook
ie	9.12	eV	NIST Webbook
ie	9.11 ± 0.01	eV	NIST Webbook

ie	9.13	eV	NIST Webbook
ie	9.32 ± 0.01	eV	NIST Webbook
ie	9.20	eV	NIST Webbook
ie	9.11 ± 0.03	eV	NIST Webbook
ie	9.36	eV	NIST Webbook
ie	9.40	eV	NIST Webbook
ie	9.29	eV	NIST Webbook
ie	9.11 ± 0.02	eV	NIST Webbook
ie	9.10	eV	NIST Webbook
ie	9.13	eV	NIST Webbook
ie	9.12 ± 0.01	eV	NIST Webbook
ie	9.13	eV	NIST Webbook
ie	9.11 ± 0.01	eV	NIST Webbook
ie	9.13 ± 0.01	eV	NIST Webbook
log10ws	-1.35		Crippen Method
logp	1.582		Crippen Method
mcvol	62.920	ml/mol	McGowan Method
nfpaf	%!d(float64=4)		KDB
nfpah	%!d(float64=1)		KDB
pc	4225.50	kPa	Thermodynamic properties of the butenes Part I. Experimental densities, vapor pressures, and critical points
pc	4210.00 ± 50.00	kPa	NIST Webbook
pc	4197.00	kPa	KDB
rhoc	240.13 ± 2.81	kg/m3	NIST Webbook
rinpol	420.00		NIST Webbook
rinpol	428.00		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	416.00		NIST Webbook
rinpol	421.00		NIST Webbook
rinpol	416.00		NIST Webbook
rinpol	420.00		NIST Webbook
rinpol	427.00		NIST Webbook
rinpol	428.00		NIST Webbook
rinpol	426.00		NIST Webbook
rinpol	418.00		NIST Webbook
rinpol	416.85		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	426.00		NIST Webbook
rinpol	425.00		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	425.00		NIST Webbook
rinpol	425.00		NIST Webbook
rinpol	416.00		NIST Webbook

rinpol	416.50		NIST Webbook
rinpol	416.50		NIST Webbook
rinpol	416.30		NIST Webbook
rinpol	416.50		NIST Webbook
rinpol	416.85		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	427.30		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	411.00		NIST Webbook
rinpol	416.00		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	418.00		NIST Webbook
rinpol	427.00		NIST Webbook
rinpol	427.00		NIST Webbook
rinpol	428.20		NIST Webbook
rinpol	420.00		NIST Webbook
rinpol	416.44		NIST Webbook
rinpol	418.18		NIST Webbook
rinpol	411.00		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	417.00		NIST Webbook
rinpol	431.00		NIST Webbook
rinpol	422.00		NIST Webbook
rinpol	426.00		NIST Webbook
rinpol	418.00		NIST Webbook
rinpol	420.00		NIST Webbook
ripol	481.00		NIST Webbook
ripol	468.00		NIST Webbook
ripol	468.00		NIST Webbook
sl	212.88	J/mol×K	NIST Webbook
sl	219.91	J/mol×K	NIST Webbook
sl	220.00	J/mol×K	NIST Webbook
tb	276.85 ± 0.60	K	NIST Webbook
tb	276.79 ± 0.20	K	NIST Webbook
tb	276.81 ± 0.55	K	NIST Webbook
tb	276.80 ± 0.30	K	NIST Webbook
tb	276.90 ± 0.50	K	NIST Webbook
tb	276.86	K	KDB
tb	276.90	K	NIST Webbook
tb	276.90	K	NIST Webbook
tc	435.50 ± 0.10	K	NIST Webbook

tc	435.55 ± 0.30	K	NIST Webbook
tc	435.58	K	KDB
tc	435.60	K	NIST Webbook
tf	133.85 ± 0.50	K	NIST Webbook
tf	134.20	K	KDB
tt	134.26 ± 0.02	K	NIST Webbook
tt	133.80 ± 0.20	K	NIST Webbook
tt	134.26 ± 0.02	K	NIST Webbook
vc	0.234	m3/kmol	NIST Webbook
vc	0.234	m3/kmol	KDB
zc	0.2711750		KDB
zra	0.27		KDB

Temperature Dependent Properties

Property code	Value	Unit	Temperature [K]	Source
cpg	70.80 ± 1.60	J/mol×K	250.00	NIST Webbook
cpg	71.70 ± 1.70	J/mol×K	260.00	NIST Webbook
cpg	72.30 ± 1.70	J/mol×K	265.00	NIST Webbook
cpg	72.90 ± 1.70	J/mol×K	270.00	NIST Webbook
cpg	73.90 ± 1.70	J/mol×K	275.00	NIST Webbook
cpg	74.70 ± 1.70	J/mol×K	280.00	NIST Webbook
cpg	75.90 ± 1.80	J/mol×K	285.00	NIST Webbook
cpg	77.20 ± 1.80	J/mol×K	290.00	NIST Webbook
cpg	88.24 ± 0.18	J/mol×K	332.85	NIST Webbook
cpg	79.90 ± 1.80	J/mol×K	300.00	NIST Webbook
cpg	81.13 ± 0.16	J/mol×K	298.58	NIST Webbook
cpg	96.27 ± 0.19	J/mol×K	371.24	NIST Webbook
cpg	78.50 ± 1.80	J/mol×K	295.00	NIST Webbook
cpg	71.10 ± 1.60	J/mol×K	255.00	NIST Webbook
cpl	127.00	J/mol×K	298.15	NIST Webbook
cpl	126.15	J/mol×K	298.15	NIST Webbook
cpl	118.87	J/mol×K	266.60	NIST Webbook
cpl	130.00	J/mol×K	299.80	NIST Webbook
dvisc	0.0003443	Pa×s	212.42	Joback Method
dvisc	0.0002406	Pa×s	239.97	Joback Method
dvisc	0.0001810	Pa×s	267.53	Joback Method
dvisc	0.0025167	Pa×s	129.76	Joback Method
dvisc	0.0010280	Pa×s	157.31	Joback Method
dvisc	0.0005483	Pa×s	184.87	Joback Method
dvisc	0.0001436	Pa×s	295.08	Joback Method

hfust	7.32	kJ/mol	133.80	NIST Webbook
hfust	7.31	kJ/mol	134.30	NIST Webbook
hfust	7.31	kJ/mol	134.30	NIST Webbook
hfust	7.31	kJ/mol	134.26	NIST Webbook
hfust	7.31	kJ/mol	134.26	NIST Webbook
hvapt	24.00	kJ/mol	300.50	NIST Webbook
hvapt	23.35	kJ/mol	276.90	KDB
hvapt	24.40	kJ/mol	255.50	NIST Webbook
hvapt	22.47	kJ/mol	246.00	NIST Webbook
hvapt	22.50	kJ/mol	246.00	NIST Webbook
hvapt	23.60	kJ/mol	407.00	NIST Webbook
hvapt	23.60	kJ/mol	355.00	NIST Webbook
hvapt	24.31	kJ/mol	276.73	NIST Webbook
hvapt	25.30	kJ/mol	231.00	NIST Webbook
hvapt	23.34	kJ/mol	276.90	NIST Webbook
pvap	1189.60	kPa	364.52	Vapor-Liquid Equilibrium for the cis-2-Butene + Methanol, + 2-Propanol, + 2-Butanol, + 2-Methyl-2-propanol Systems at 364.5 K
pvap	1190.50	kPa	364.52	Vapor-Liquid Equilibrium for the cis-2-Butene + Methanol, + 2-Propanol, + 2-Butanol, + 2-Methyl-2-propanol Systems at 364.5 K
pvap	1213.01	kPa	365.43	Vapor Liquid Equilibrium for Six Binary Systems of C4-Hydrocarbons + 2-Propanone
pvap	561.34	kPa	331.92	Vapor-Liquid Equilibrium for 1-Propanol + 1-Butene, + cis-2-Butene, + 2-Methyl-propene, + trans-2-Butene, + n-Butane, and + 2-Methyl-propane

pvap	333.00	kPa	312.58	Vapour liquid equilibrium for the systems diethyl sulphide + 1-butene, +cis-2-butene, +2-methylpropane, +2-methylpropene, +n-butane, +trans-2-butene
pvap	332.20	kPa	312.59	Isothermal binary vapour liquid equilibrium for butanes and butenes with dimethylsulphide
pvap	391.45	kPa	318.40	Vapour liquid equilibrium for the ethyl ethanoate + 1-butene, +cis-2-butene, +trans-2-butene, +2-methylpropene, +n-butane and +2-methylpropane
pvap	1190.70	kPa	364.53	Vapor-Liquid Equilibrium for the cis-2-Butene + Methanol, + 2-Propanol, + 2-Butanol, + 2-Methyl-2-propanol Systems at 364.5 K
rhol	621.00	kg/m3	293.00	KDB
sfust	54.69	J/mol×K	133.80	NIST Webbook
sfust	54.44	J/mol×K	134.26	NIST Webbook
sfust	54.40	J/mol×K	134.26	NIST Webbook
srf	0.01	N/m	293.20	KDB

Correlations

Information	Value
Property code	pvap
Equation	ln(Pvp) = A + B/(T + C)
Coeff. A	1.41690e+01
Coeff. B	-2.36784e+03
Coeff. C	-2.89160e+01
Temperature range (K), min.	199.49
Temperature range (K), max.	296.24

Information	Value
Property code	pvap
Equation	ln(Pvp) = A + B/T + C*ln(T) + D*T^2
Coeff. A	6.95121e+01
Coeff. B	-4.81722e+03
Coeff. C	-8.60007e+00
Coeff. D	1.13381e-05
Temperature range (K), min.	134.26
Temperature range (K), max.	435.58

Sources

Henry's Law Constants and Infinite Dilution Activity Coefficients of Propane, Propene, Butane, 2-Methylpropane, 1-Butene, 2-Methylpropene, trans-2-Butene, cis-2-Butene, 1,3-Butadiene, Dimethyl Ether, Chloroethane, and 1,1-Difluoroethane in 2-Methylphenol, 3-Methylphenol, and 4-Methylphenol:	https://www.doi.org/10.1021/je100529s
Henry's Law Constants and Infinite Dilution Activity Coefficients of Propane, Propene, Butane, 2-Methylpropane, 1-Butene, 2-Methylpropene, trans-2-Butene, cis-2-Butene, 1,3-Butadiene, Dimethyl Ether, Chloroethane, and 1,1-Difluoroethane in 2-Methyl-3-buten-2-ol and 3-Methyl-3-buten-1-ol:	https://www.doi.org/10.1021/je050343i
NIST Webbook	http://webbook.nist.gov/cgi/cbook.cgi?ID=C590181&Units=SI
Isothermal binary vapour liquid equilibrium for butanes and butenes with dimethylsulphide:	https://www.doi.org/10.1016/j.fluid.2008.01.030
KDB	https://www.cheric.org/research/kdb/hcprop/showprop.php?cmpid=187
KDB Vapor Pressure Data:	https://www.cheric.org/research/kdb/hcprop/showprop.php?cmpid=187
Vapour liquid equilibrium for the ethyl ethanoate + 1-butene, +cis-2-butene, +trans-2-butene, +2-methylpropene, +n-butane and +2-methylpropane:	https://www.doi.org/10.1016/j.fluid.2004.10.023
Vapour-liquid equilibrium for the systems diethyl sulphide + 1-butene, +cis-2-butene, +2-methylpropane, +2-methylpropene, +n-butane, +trans-2-butene:	https://www.doi.org/10.1016/j.fluid.2010.01.006
Vapor-Liquid Equilibrium for Six Binary Systems of C4 Hydrocarbons + 2-Propanone:	https://www.doi.org/10.1021/je050403k
Vapor-Liquid Equilibrium for the cis-2-Butene + Methanol, + 2-Propanol, + 2-Butanol, + 2-Methyl-2-propanol Systems at 364.5 K:	https://www.doi.org/10.1021/je800088e
Vapor-Liquid Equilibrium for 1-Propanol + 1-Butene, + cis-2-Butene, + 2-Methyl-propene, + trans-2-Butene, + n-Butane, and + 2-Methyl-propane:	https://www.doi.org/10.1021/je049959i
The Yaws Handbook of Vapor Pressure:	https://www.sciencedirect.com/book/9780128029992/the-yaws-handbook-of-vapor-pressure
Crippen Method:	https://www.chemeo.com/doc/models/crippen_log10ws
Henry's law constants and infinite dilution activity coefficients of cis-2-butene, dimethylether, chloroethane, and 1,1-difluoroethane in methanol, 1-propanol, 2-propanol, 1-butanol, 2-butanol, isobutanol, tert-butanol, 1-pentanol, 2-pentanol, 3-pentanol, 2-methyl-1-butanol, 3-methyl-1-butanol, and 2-methyl-2-butanol:	https://www.doi.org/10.1016/j.jct.2005.08.004
Crippen Method:	http://pubs.acs.org/doi/abs/10.1021/ci990307l
Henry's Law Constants and Infinite Dilution Activity Coefficients of Propane, Propene, Butane, 2-Methylpropane, 1-Butene, 2-Methylpropene, trans-2-Butene, cis-2-Butene, 1,3-Butadiene, Dimethyl Ether, Chloroethane, and 1,1-Difluoroethane in 2-Propen-1-ol:	https://www.doi.org/10.1021/je0502647
Henry's Law Constants and Infinite Dilution Activity Coefficients of Propane, Propene, Butane, 2-Methylpropane, 1-Butene, 2-Methylpropene, trans-2-Butene, cis-2-Butene, 1,3-Butadiene, Dimethylether, Chloroethane, 1,1-Difluoroethane, and Hexane in Tetrahydropyran:	https://www.doi.org/10.1021/je700270d
[illegible]	http://link.springer.com/article/10.1007/BF02311772
Joback Method:	https://en.wikipedia.org/wiki/Joback_method
Henry's Law Constants and Infinite Dilution Activity Coefficients of Propane, Propene, Butane, 2-Methylpropane, 1-Butene, 2-Methylpropene, trans-2-Butene, cis-2-Butene, 1,3-Butadiene, Dimethyl Ether, Chloroethane, and 1,1-Difluoroethane in Benzene, Toluene, o-Xylene, m-Xylene, p-Xylene, and Styrene:	https://www.doi.org/10.1021/je060395n
Thermodynamic properties of the butenes. Part II. Experimental densities, vapor pressures, and critical points:	https://www.doi.org/10.1016/j.fluid.2004.09.013

Legend

af:	Acentric Factor
chg:	Standard gas enthalpy of combustion
cpg:	Ideal gas heat capacity
cpl:	Liquid phase heat capacity
dm:	Dipole Moment
dvisc:	Dynamic viscosity
gf:	Standard Gibbs free energy of formation
hcg:	Heat of Combustion, Gross form
hcn:	Heat of Combustion, Net Form
hf:	Enthalpy of formation at standard conditions
hfus:	Enthalpy of fusion at standard conditions
hfust:	Enthalpy of fusion at a given temperature
hvap:	Enthalpy of vaporization at standard conditions
hvapt:	Enthalpy of vaporization at a given temperature
ie:	Ionization energy
log10ws:	Log10 of Water solubility in mol/l
logp:	Octanol/Water partition coefficient
mcvol:	McGowan's characteristic volume
nfpaf:	NFPA Fire Rating
nfpah:	NFPA Health Rating
pc:	Critical Pressure
pvap:	Vapor pressure
rhoc:	Critical density
rhol:	Liquid Density
rinpol:	Non-polar retention indices
ripol:	Polar retention indices
sfust:	Entropy of fusion at a given temperature
sl:	Liquid phase molar entropy at standard conditions
srf:	Surface Tension
tb:	Normal Boiling Point Temperature
tc:	Critical Temperature
tf:	Normal melting (fusion) point
tt:	Triple Point Temperature
vc:	Critical Volume
zc:	Critical Compressibility
zra:	Rackett Parameter