Ammonia

Other names:	AMMONIA GAS
	Ammonia, anhydrous
	Anhydrous ammonia
	Aromatic Ammonia, Vaporole
	NH3
	NITRO-SIL
	Spirit of Hartshorn
Inchi:	InChI=1S/H3N/h1H3
InchiKey:	QGZKDVFQNNGYKY-UHFFFAOYSA-N
Formula:	H3N
SMILES:	N
Mol. weight [g/mol]:	17.03
CAS:	7664-41-7

Physical Properties

Property code	Value	Unit	Source
af	0.2500		KDB
affp	853.60	kJ/mol	NIST Webbook
aigt	924.26	K	KDB
basg	819.00	kJ/mol	NIST Webbook
dm	1.50	debye	KDB
fll	15.50	% in Air	KDB
flu	27.00	% in Air	KDB
gf	-16.16	kJ/mol	KDB
gyrad	0.8530		KDB
hf	-45.94 ± 0.35	kJ/mol	NIST Webbook
hf	-45.72	kJ/mol	KDB
ie	10.15	eV	NIST Webbook
ie	10.15 ± 0.01	eV	NIST Webbook
ie	10.82	eV	NIST Webbook
ie	15.02	eV	NIST Webbook
ie	10.16	eV	NIST Webbook
ie	10.16 ± 0.01	eV	NIST Webbook
ie	10.17	eV	NIST Webbook
ie	10.16 ± 0.02	eV	NIST Webbook
ie	14.92	eV	NIST Webbook
ie	10.14	eV	NIST Webbook

ie	10.80	eV	NIST Webbook
ie	10.85	eV	NIST Webbook
ie	11.30	eV	NIST Webbook
ie	10.19	eV	NIST Webbook
ie	10.85	eV	NIST Webbook
ie	14.94 ± 0.03	eV	NIST Webbook
ie	10.18 ± 0.01	eV	NIST Webbook
ie	10.07 ± 0.02	eV	NIST Webbook
ie	10.02	eV	NIST Webbook
ie	10.07 ± 0.01	eV	NIST Webbook
ie	10.20	eV	NIST Webbook
ie	10.07 ± 0.00	eV	NIST Webbook
ie	10.07 ± 0.01	eV	NIST Webbook
ie	10.30 ± 0.00	eV	NIST Webbook
ie	10.45	eV	NIST Webbook
ie	10.20	eV	NIST Webbook
ie	10.18 ± 0.09	eV	NIST Webbook
ie	10.17	eV	NIST Webbook
log10ws	7.60		Crippen Method
logp	0.162		Crippen Method
mcvol	20.840	ml/mol	McGowan Method
nfpaf	%!d(float64=1)		KDB
nfpah	%!d(float64=3)		KDB
pc	11350.00	kPa	KDB
pc	11300.00 ± 5.00	kPa	NIST Webbook
pt	6.06 ± 0.01	kPa	NIST Webbook
pt	6.08	kPa	KDB
rinpol	131.00		NIST Webbook
rinpol	118.00		NIST Webbook
sgb	192.77 ± 0.05	J/mol×K	NIST Webbook
tb	239.82	K	KDB
tc	405.40 ± 0.10	K	NIST Webbook
tc	405.56	K	Critical parameters for ammonia
tc	405.50	K	KDB
tc	405.60 ± 5.00	K	NIST Webbook
tf	195.41	K	KDB
tf	194.95 ± 0.30	K	NIST Webbook
tt	195.41	K	KDB
vc	0.072	m3/kmol	KDB
zc	0.2423820		KDB
zra	0.25		KDB

Temperature Dependent Properties

Property code	Value	Unit	Temperature [K]	Source
cpl	89.36	J/mol×K	334.09	Densities, Viscosities, Heat Capacities, and Vapor Liquid Equilibria of Ammonia + Sodium Thiocyanate Solutions at Several Temperatures
cpl	85.83	J/mol×K	324.11	Densities, Viscosities, Heat Capacities, and Vapor Liquid Equilibria of Ammonia + Sodium Thiocyanate Solutions at Several Temperatures
cpl	83.45	J/mol×K	314.14	Densities, Viscosities, Heat Capacities, and Vapor Liquid Equilibria of Ammonia + Sodium Thiocyanate Solutions at Several Temperatures
cpl	82.46	J/mol×K	304.17	Densities, Viscosities, Heat Capacities, and Vapor Liquid Equilibria of Ammonia + Sodium Thiocyanate Solutions at Several Temperatures
hsubt	31.20	kJ/mol	186.00	NIST Webbook
hvapt	22.70	kJ/mol	342.50	NIST Webbook
hvapt	23.50	kJ/mol	220.00	NIST Webbook
hvapt	23.40	kJ/mol	239.00	NIST Webbook

pvap	151.70	kPa	248.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
pvap	354.80	kPa	268.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
pvap	429.30	kPa	273.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
pvap	515.50	kPa	278.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
pvap	615.10	kPa	283.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K

pvap	728.50	kPa	288.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
pvap	119.70	kPa	243.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
pvap	1166.00	kPa	303.12	Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures
pvap	1553.00	kPa	313.14	Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures
pvap	2030.00	kPa	323.16	Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures
pvap	2609.00	kPa	333.13	Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures
pvap	3305.00	kPa	343.13	Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures

pvap	4132.00	kPa	353.13	Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures
pvap	5105.00	kPa	363.12	Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures
pvap	6243.00	kPa	373.16	Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures
pvap	290.70	kPa	263.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
pvap	236.40	kPa	258.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
pvap	190.20	kPa	253.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K

pvap	857.10	kPa	293.15	The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2-tetrafluoroethane) system over the temperatures ranging from (243.150 to 283.150) K
rhol	639.00	kg/m3	273.00	KDB

Correlations

Information	Value
Property code	pvap
Equation	ln(Pvp) = A + B/(T + C)
Coeff. A	1.54557e+01
Coeff. B	-2.33432e+03
Coeff. C	-2.43200e+01
Temperature range (K), min.	195.41
Temperature range (K), max.	405.65

Datasets

Molar heat capacity at constant pressure, J/K/mol

Pressure, kPa - Liquid	Temperature, K - Liquid	Molar heat capacity at constant pressure, J/K/mol - Liquid
1000.00	280.00	76.81
5000.00	280.00	75.62
5000.00	300.00	76.81
5000.00	320.00	77.83
5000.00	360.00	95.20
10000.00	360.00	92.82
15000.00	360.00	90.26

Reference *https://www.doi.org/10.1016/j.jct.2007.06.013*

Kinematic viscosity, m2/s

Temperature, K - Gas	Pressure, kPa - Gas	Kinematic viscosity, m2/s - Gas
300.00	223.53	0.0000065
300.00	259.87	0.0000055
300.00	329.51	0.0000043
300.00	361.99	0.0000040
300.00	447.86	0.0000031
300.00	465.77	0.0000030
300.00	568.68	0.0000024
300.00	569.79	0.0000025
300.00	676.75	0.0000020
300.00	692.80	0.0000020
300.00	802.37	0.0000017
300.00	802.82	0.0000017
315.00	250.83	0.0000064
315.00	378.83	0.0000042
315.00	506.43	0.0000031
315.00	661.04	0.0000023
315.00	791.02	0.0000019
315.00	938.74	0.0000016
315.00	1080.91	0.0000014
315.00	1284.99	0.0000011
330.00	308.27	0.0000058
330.00	473.84	0.0000037
330.00	664.29	0.0000026
330.00	822.59	0.0000021
330.00	977.41	0.0000017
330.00	1142.12	0.0000014
330.00	1294.82	0.0000013
330.00	1480.49	0.0000011
330.00	1640.80	0.0000010
330.00	1792.05	0.0000009
330.00	1945.84	0.0000008
345.00	297.74	0.0000065
345.00	504.54	0.0000038
345.00	708.88	0.0000027
345.00	914.14	0.0000020
345.00	1123.20	0.0000016
345.00	1332.13	0.0000014

345.00	1537.04	0.0000012
345.00	1744.59	0.0000010
345.00	1955.14	0.0000009
345.00	2315.57	0.0000007
345.00	2530.02	0.0000006
345.00	2769.00	0.0000006
360.00	242.70	0.0000087
360.00	453.28	0.0000047
360.00	661.35	0.0000032
360.00	865.15	0.0000024
360.00	1069.66	0.0000019
360.00	1277.79	0.0000016
360.00	1481.15	0.0000013
360.00	1690.65	0.0000012
360.00	1894.78	0.0000010
360.00	2277.38	0.0000008
360.00	2480.70	0.0000007
360.00	2738.78	0.0000007
360.00	3050.47	0.0000006
360.00	3365.40	0.0000005
375.00	260.57	0.0000101
375.00	483.31	0.0000049
375.00	684.74	0.0000034
375.00	897.66	0.0000026
375.00	1130.68	0.0000020
375.00	1341.71	0.0000016
375.00	1583.75	0.0000014
375.00	1793.43	0.0000012
375.00	2026.26	0.0000010
375.00	2290.42	0.0000009
375.00	2599.92	0.0000008
375.00	2933.13	0.0000007
375.00	3140.48	0.0000006
375.00	3379.20	0.0000006

Reference *https://www.doi.org/10.1016/j.jct.2007.07.002*

Mass density, kg/m3

Temperature, K - Liquid	Pressure, kPa - Liquid	Mass density, kg/m3 - Liquid
450.00	30000.00	355.3

450.00	40000.00	403.7
450.00	50000.00	433.4
450.00	60000.00	455.2
450.00	70000.00	472.6
450.00	80000.00	487.4
450.00	90000.00	500.2
450.00	100000.00	511.7
450.00	120000.00	531.4
450.00	140000.00	548.2
450.00	160000.00	563.1
450.00	180000.00	576.3
450.00	200000.00	588.2
500.00	50000.00	350.9
500.00	60000.00	384.9
500.00	70000.00	410.1
500.00	80000.00	430.2
500.00	90000.00	446.9
500.00	100000.00	461.5
500.00	120000.00	485.8
500.00	140000.00	505.9
500.00	160000.00	523.1
500.00	180000.00	538.3
500.00	200000.00	551.9

Reference *https://www.doi.org/10.1016/j.jct.2008.06.009*

Speed of sound, m/s

Temperature, K - Fluid (supercritical or subcritical phases)	Pressure, kPa - Fluid (supercritical or subcritical phases)	Speed of sound, m/s - Fluid (supercritical or subcritical phases)
297.00	620000.00	2741.0
297.00	700000.00	2836.0
297.00	780000.00	2942.0
297.00	880000.00	3023.0
297.00	970000.00	3113.0
297.00	780000.00	2932.0
298.00	370000.00	2376.0
298.00	740000.00	2903.0
474.00	1430000.00	3280.0
476.00	1550000.00	3375.0
476.00	2200000.00	3788.0

477.00	1090000.00	2954.0
479.00	2220000.00	3797.0
678.00	2920000.00	4000.0
678.00	3080000.00	4072.0
678.00	3140000.00	4103.0
679.00	1480000.00	3084.0
679.00	2440000.00	3740.0
679.00	3750000.00	4342.0
680.00	1350000.00	2982.0
680.00	1350000.00	2970.0

Reference *https://www.doi.org/10.1021/je800312g*

Sources

An Experimental Study of the pVTx Properties for Aqueous Solutions of Ammonia Focusing on the Maximum Density Regions:	https://www.doi.org/10.1007/s10765-005-8590-7
Solubility of ammonia in liquid mixtures of (water + methanol):	https://www.doi.org/10.1016/j.fluid.2007.07.049
Investigation on vapor liquid equilibria for binary systems of metal ion containing ionic liquid	https://www.doi.org/10.1016/j.fluid.2013.09.011
Critical parameters for ammonia: [bmim]Zn2Cl5/NH3 by experiment and modified UNIFAC (Dortmund):	https://www.doi.org/10.1016/j.jct.2004.12.016
Solubilities of ammonia in basic imidazolium ionic liquids :	https://www.doi.org/10.1016/j.fluid.2010.06.005
Vapor Pressures and Liquid Densities of Ammonium Bromide + Ammonia Mixtures:	https://www.doi.org/10.1021/je900359y
Crippen Method:	https://www.chemeo.com/doc/models/crippen_log10ws
Effects of association with impurities in ammonia purification:	https://www.doi.org/10.1016/j.fluid.2015.07.034
The experimental investigation of the vapour liquid phase equilibrium for (ammonia + 2,3,3,3-tetrafluoroprop-1-ene) system:	https://www.doi.org/10.1016/j.jct.2017.06.018
NH3 Solubilities and Physical Properties of Ethylamine Hydrochloride Ionic Liquid + Ethanol Solvents:	https://www.doi.org/10.1021/acs.jced.9b00246
Densities and Heat Capacities of the Ammonia + Water + NaOH and Ammonia + Water + KOH Solutions:	https://www.doi.org/10.1021/je050512z
The (p,ρ,T,x) properties for {xNH3 + (1 x)H2O} at T = (450 and 500) K over the pressure range from (10 to 200) MPa:	https://www.doi.org/10.1016/j.jct.2008.06.009
Vapor-Liquid Equilibrium of Ammonia + Lithium Nitrate + Water and Ammonia + Lithium Nitrate Solutions from (293.15 to 353.15) K:	https://www.doi.org/10.1021/je7000045
Measurements of the critical parameters for {xNH3 + (1 x)H2O} with x = (0.9098, 0.7757,0.6808):	https://www.doi.org/10.1016/j.jct.2008.05.017
KDB:	https://www.cheric.org/research/kdb/hcprop/showprop.php?cmpid=1918
Densities, Viscosities, Heat Capacities, and Vapor Liquid Equilibria of Ammonia + Sodium Thiocyanate Solutions at Several Temperatures:	https://www.doi.org/10.1021/je200038n
Vapour pressure measurements of ammonia/ionic liquids mixtures as suitable alternative working fluids for absorption refrigeration technology:	https://www.doi.org/10.1016/j.fluid.2018.01.006
Solubilities of ammoniacal choline chloride plus urea at (298.2 353.2) K:	https://www.doi.org/10.1016/j.jct.2018.09.020
Speed of Sound in Fluid Ammonia to 3.8 GPa and 680 K:	https://www.doi.org/10.1021/je800312g
The investigation on the vapour liquid phase equilibrium of (ammonia + 1,1,1,2- tetrafluoroethane) system over the temperatures among from (243.150 to 283.150) K:	https://www.doi.org/10.1016/j.jct.2017.01.019
Solubility and thermodynamic properties of NH3 in choline chloride/urea deep eutectic solvents:	https://www.doi.org/10.1016/j.jct.2019.01.031
The Yaws Handbook of Vapor Pressure:	https://www.sciencedirect.com/book/9780128029992/the-yaws-handbook-of-vapor-pressure
Solubility of ammonium chloride in a MgCl2-NH4Cl-NH3-H2O system at 298 K: Experiments, modeling and prediction:	https://www.doi.org/10.1016/j.fluid.2014.10.014
New device for measuring the solubility of inorganic salts in liquid ammonia:	https://www.doi.org/10.1016/j.fluid.2013.06.042
Densities, Viscosities, and Heat Capacities of Ammonia + Lithium Nitrate and Ammonia + Lithium Nitrate + Water Solutions between (293.15 and 353.15) K:	https://www.doi.org/10.1021/je8003035
Experimental Investigation of the Solubility of Ammonia in Methanol:	https://www.doi.org/10.1021/je700033y

NIST Webbook:	http://webbook.nist.gov/cgi/cbook.cgi?ID=C7664417&Units=SI
Solubilities and Thermodynamic Properties of NH3 in Glycerin and its Derivatives:	https://www.doi.org/10.1021/acs.jced.8b01042
Vapor Liquid Equilibria of Ammonia + Water + Potassium Hydroxide and Ammonia + Water + Sodium Hydroxide Solutions at Temperatures from (293.15 to 353.15) K:	https://www.doi.org/10.1021/je049708+
Evaluation of Methanesulfonate-Based Deep Eutectic Solvent for Ammonia Capture:	https://www.doi.org/10.1021/acs.jced.7b01004
Vapor Pressures and Liquid Densities of Ammonium Chloride + Ammonia Mixtures:	https://www.doi.org/10.1021/je8001267
Solid-Liquid Phase Diagram for the System MgCl2-NH3-CH3OH at 298 K:	https://www.doi.org/10.1021/je9008359
Densities and viscosities of, and NH3 solubilities in deep eutectic solvents composed of ethylammine hydrochloride and acetamide:	https://www.doi.org/10.1016/j.jct.2019.105883
Vapor Pressures and Liquid Densities of Ammonium Iodide + Ammonia Mixtures:	https://www.doi.org/10.1021/je9006713
Vapor liquid equilibria of NH3 in (NH3 + H2O) and (NH3 + PZ + H2O) system:	https://www.doi.org/10.1016/j.fluid.2011.08.017
Vapor Liquid Equilibrium Measurements of NH3 + H2O + Ionic Liquid ([Dmim]Cl, [Dmim]BF4, and [Dmim]DMP) Systems:	https://www.doi.org/10.1021/je400109a
McGowan Method:	http://link.springer.com/article/10.1007/BF02311772
Crippen Method:	http://pubs.acs.org/doi/abs/10.1021/ci990307l
Vapor liquid equilibrium of CO2 in NH3 CO2 SO2 H2O system:	https://www.doi.org/10.1016/j.fluid.2014.11.015
Binary Diffusion Coefficient Data of Various Gas Systems Determined Using a Loschmidt Cell and Holographic Interferometry:	https://www.doi.org/10.1007/s10765-015-1981-5
Isobaric specific heat capacity of (H2O + (1 - x) NH3) with x = (0.0000, 0.1998, 0.1587, 0.3030, 0.3048, 0.4956, 0.7061, and 1.0000) at T = (298, 300, 310, and 350) K over the pressure range from (0.1 to 15) MPa:	https://www.doi.org/10.1016/j.jct.2007.06.013
Behavior of the Isochoric Heat Capacity Solubility of N2O in and Density and Viscosity of Aqueous Solutions of Piperazine, Ammonia, and Their Mixtures:	https://www.doi.org/10.1007/s10765-009-0602-6
Solubility of Nitrous Oxide and Density and Viscosity of Aqueous Solutions of Piperazine and Its Mixtures with Ammonia:	https://www.doi.org/10.1021/je300102d
Kinematic viscosity and speed of sound in gaseous CO, CO2, SiF4, SF6, CHF3, and NH3 from 220 K to 375 K and pressures up to 70 MPa:	https://www.doi.org/10.1016/j.jct.2007.07.002
Investigation of Thermodynamic Properties on CO2 Absorbents Blended with Ammonia, Amino Acids, and Corrosion Inhibitors at 313.15, 333.15, and 353.15 K:	https://www.doi.org/10.1021/acs.jced.8b00175
The solubility of ammonia in ethanol between 277.35 K and 328.15 K:	https://www.doi.org/10.1016/j.fluid.2011.01.006

Legend

af:	Acentric Factor
affp:	Proton affinity
aigt:	Autoignition Temperature
basg:	Gas basicity
cpl:	Liquid phase heat capacity
dm:	Dipole Moment
fll:	Lower Flammability Limit
flu:	Upper Flammability Limit
gf:	Standard Gibbs free energy of formation
gyrad:	Radius of Gyration
hf:	Enthalpy of formation at standard conditions
hsubt:	Enthalpy of sublimation at a given temperature
hvapt:	Enthalpy of vaporization at a given temperature
ie:	Ionization energy
kvisc:	Kinematic viscosity
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
pt:	Triple Point Pressure
pvap:	Vapor pressure
rhol:	Liquid Density
rinpol:	Non-polar retention indices
sgb:	Molar entropy at standard conditions (1 bar)
speedsl:	Speed of sound in fluid
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