AZEOTROPIC DATA FOR BINARY MIXTURES

Liquid mixtures having an extremum (maximum or minimum) vapor pressure at constant temperature, as a function of composition, are called azeotropic mixtures, or simply azeotropes. Mixtures that do not show a maximum or minimum are called zeotropic. Azeotropes in which the pressure is a maximum are often called positive azeotropes, while pressure-minimum azeotropes are called negative azeotropes. The coordinates of an azeotropic point are the azeotropic temperature t_{az}, pressure P_{az}, and liquid-phase composition, usually expressed as mole fractions. At the azeotropic point, the vapor-phase composition is the same as the liquid-phase composition.

This table gives azeotropic data for a number of binary mixtures at normal atmospheric pressure (P_{az} =101.3 kPa). Component 1 of each mixture is given in bold face. The temperature t_{az} and mole fraction x_1 of component 1 are listed for each choice of component 2.

The components are arranged in a modified Hill order, with substances that do not contain carbon preceding those that do contain carbon.

REFERENCES

1. Lide, D.R., and Kehiaian, H.V., *CRC Handbook of Thermophysical and Thermochemical Data*, CRC Press, Boca Raton, FL, 1994.
2. Horsley, L.H., *Azeotropic Data, III*, American Chemical Society, Washington, D.C., 1973.

Molecular formula	Name	t_{az}/°C	x_1
	Water H_2O		
$CHCl_3$	Trichloromethane	56.1	0.160
CH_2O_2	Formic acid	107.2	0.427
CH_3NO_2	Nitromethane	83.6	0.511
CS_2	Carbon disulfide	42.6	0.109
C_2H_3N	Acetonitrile	76.5	0.307
$C_2H_5NO_2$	Nitroethane	87.2	0.624
C_2H_6O	Ethanol	78.2	0.096
$C_4H_8O_2$	Ethyl acetate	70.4	0.312
$C_4H_{10}O$	1-Butanol	92.7	0.753
$C_4H_{10}O$	2-Butanol	87	0.601
C_5H_5N	Pyridine	93.6	0.755
$C_5H_{11}N$	Piperidine	92.8	0.718
C_5H_{12}	Pentane	34.6	0.054
C_6H_5Cl	Chlorobenzene	90.2	0.712
C_6H_6	Benzene	69.3	0.295
C_6H_6O	Phenol	99.5	0.981
C_6H_{10}	Cyclohexene	70.8	0.308
C_6H_{12}	Cyclohexane	69.5	0.300
C_6H_{14}	Hexane	61.6	0.221
C_7H_8	Toluene	84.1	0.444
C_7H_{16}	Heptane	79.2	0.452
C_8H_{10}	1,3-Dimethylbenzene	92	0.767
C_8H_{10}	Ethylbenzene	92	0.744
C_8H_{18}	Octane	89.6	0.673
$C_8H_{18}O$	Dibutyl ether	92.9	0.781
C_9H_{20}	Nonane	94.8	0.970
$C_{12}H_{27}N$	Tributylamine	99.7	0.976
	Tetrachloromethane CCl_4		
CH_2O_2	Formic acid	66.7	0.569
CH_3NO_2	Nitromethane	71.3	0.660
CH_4O	Methanol	55.7	0.445
C_2H_3N	Acetonitrile	65.1	0.566
C_2H_6O	Ethanol	65.0	0.615
C_3H_6O	Acetone	56.1	0.047
C_3H_8O	1-Propanol	73.4	0.820
$C_4H_{10}O$	1-Butanol	76.6	0.951
	Formic acid CH_2O_2		
CS_2	Carbon disulfide	42.6	0.253
	Nitromethane CH_3NO_2		
CS_2	Carbon disulfide	41.2	0.845
	Methanol CH_4O		
C_3H_6O	Acetone	55.5	0.198

AZEOTROPIC DATA FOR BINARY MIXTURES (continued)

Molecular formula	Name	t_{az}/°C	x_1
$C_3H_6O_2$	Methyl acetate	53.5	0.352
C_5H_{10}	Cyclopentane	38.8	0.263
C_5H_{12}	Pentane	30.9	0.145
$C_5H_{12}O$	*tert*-Butyl methyl ether	51.3	0.315
C_6H_6	Benzene	57.5	0.610
C_6H_{12}	Cyclohexane	53.9	0.601
C_7H_8	Toluene	63.5	0.883
C_7H_{16}	Heptane	59.1	0.769
C_8H_{18}	Octane	62.8	0.881
C_9H_{20}	Nonane	64.1	0.953
	Carbon disulfide CS_2		
C_2H_6O	Ethanol	42.6	0.860
C_3H_6O	Acetone	39.3	0.608
C_3H_8O	1-Propanol	45.7	0.931
$C_4H_8O_2$	Ethyl acetate	46.1	0.974
	Acetonitrile C_2H_3N		
C_2H_6O	Ethanol	72.5	0.469
C_7H_8	Toluene	81.4	0.900
	Acetic acid $C_2H_4O_2$		
$C_4H_8O_2$	1,4-Dioxane	119.5	0.831
C_5H_5N	Pyridine	138.1	0.579
C_6H_6	Benzene	80.1	0.026
C_6H_{12}	Cyclohexane	78.8	0.130
C_6H_{14}	Hexane	68.3	0.084
$C_6H_{15}N$	Triethylamine	163	0.774
C_7H_8	Toluene	100.7	0.375
C_7H_{16}	Heptane	91.7	0.451
C_8H_{10}	Ethylbenzene	114.7	0.774
C_8H_{18}	Octane	105.7	0.688
C_9H_{20}	Nonane	112.9	0.826
	Iodoethane C_2H_5I		
C_6H_{14}	Hexane	64.7	0.420
	Ethanol C_2H_6O		
C_5H_{10}	Cyclopentane	44.7	0.110
C_5H_{12}	Pentane	34.3	0.076
C_6H_6	Benzene	67.9	0.440
C_6H_{12}	Cyclohexane	64.8	0.430
C_6H_{14}	Hexane	58.7	0.332
C_7H_8	Toluene	76.7	0.810
C_8H_{18}	Octane	77	0.898
	Ethylene glycol $C_2H_6O_2$		
C_7H_8	Toluene	110.1	0.034
C_7H_{16}	Heptane	97.9	0.048
$C_8H_{18}O$	Dibutyl ether	139.5	0.125
$C_{10}H_{22}$	Decane	161	0.406
	Dimethyl sulfide C_2H_6S		
C_5H_{12}	Pentane	31.8	0.503
	1,2-Ethanediamine $C_2H_8N_2$		
C_7H_8	Toluene	104	0.406
	Propanenitrile C_3H_5N		
C_6H_{14}	Hexane	63.5	0.134
	Acetone C_3H_6O		
$C_3H_6O_2$	Methyl acetate	55.8	0.544
C_5H_{10}	Cyclopentane	41	0.404
C_6H_{12}	Cyclohexane	53	0.751
	Ethyl formate $C_3H_6O_2$		
C_5H_{12}	Pentane	32.5	0.294
	Methyl acetate $C_3H_6O_2$		
C_6H_{12}	Cyclohexane	55.5	0.801

AZEOTROPIC DATA FOR BINARY MIXTURES (continued)

Molecular formula	Name	t_{az}/°C	x_1
C_6H_{14}	Hexane	51.8	0.642
	Propanoic acid $C_3H_6O_2$		
C_5H_5N	Pyridine	148.6	0.686
C_7H_{16}	Heptane	97.8	0.027
C_9H_{12}	Propylbenzene	139.5	0.830
	1-Nitropropane $C_3H_7NO_2$		
C_3H_8O	1-Propanol	97.0	0.061
C_7H_{16}	Heptane	96.6	0.149
	1-Propanol C_3H_8O		
$C_4H_8O_2$	1,4-Dioxane	95.3	0.642
C_6H_6	Benzene	77.1	0.209
C_6H_{12}	Cyclohexane	74.7	0.241
C_7H_{16}	Heptane	84.6	0.470
	2-Propanol C_3H_8O		
$C_4H_{11}N$	Butylamine	74.7	0.646
C_5H_{12}	Pentane	35.5	0.071
C_6H_{12}	Cyclohexane	69.4	0.397
C_7H_8	Toluene	80.6	0.773
	Ethyl methyl sulfide C_3H_8S		
C_6H_{12}	Methylcyclopentane	65.6	0.664
C_6H_{14}	2,2-Dimethylpentane	66.4	0.908
	1-Propanethiol C_3H_8S		
C_6H_{12}	Cyclohexane	67.8	0.978
C_6H_{14}	Hexane	64.4	0.557
$C_6H_{14}O$	Diisopropyl ether	65.9	0.714
	Thiophene C_4H_4S		
C_6H_{12}	Cyclohexane	77.9	0.412
C_6H_{14}	Hexane	68.5	0.114
	Butanal C_4H_8O		
C_6H_{14}	Hexane	60	0.296
	2-Butanone C_4H_8O		
C_4H_9Cl	1-Chlorobutane	77	0.440
$C_4H_{11}N$	Butylamine	74	0.353
C_6H_6	Benzene	78.3	0.460
C_6H_{12}	Cyclohexane	71.8	0.438
C_7H_{16}	Heptane	77	0.764
	Butanoic acid $C_4H_8O_2$		
C_5H_5N	Pyridine	163.2	0.912
C_6H_5Cl	Chlorobenzene	131.8	0.035
C_8H_{10}	1,2-Dimethylbenzene	143	0.118
	1,4-Dioxane $C_4H_8O_2$		
C_4H_9Br	1-Bromobutane	98	0.580
	Ethyl acetate $C_4H_8O_2$		
C_6H_{14}	Hexane	65.2	0.394
	Methyl propanoate $C_4H_8O_2$		
C_4H_9Cl	1-Chlorobutane	76.8	0.392
	Propyl formate $C_4H_8O_2$		
C_4H_9Cl	1-Chlorobutane	76.1	0.392
C_6H_6	Benzene	78.5	0.440
C_6H_{12}	Cyclohexane	75	0.469
	1-Butanol $C_4H_{10}O$		
C_5H_5N	Pyridine	118.6	0.704
C_6H_5Cl	Chlorobenzene	115.3	0.659
C_6H_{10}	Cyclohexene	82	0.055
C_7H_8	Toluene	105.5	0.324
C_7H_{16}	Heptane	93.9	0.229
C_8H_{10}	1,2-Dimethylbenzene	116.8	0.811
$C_8H_{18}O$	Dibutyl ether	117.7	0.892

AZEOTROPIC DATA FOR BINARY MIXTURES (continued)

Molecular formula	Name	t_{az}/°C	x_1
	2-Butanol $C_4H_{10}O$		
C_6H_6	Benzene	78.5	0.161
C_7H_{16}	Heptane	88.1	0.439
	Diethyl ether $C_4H_{10}O$		
C_5H_{12}	Pentane	33.7	0.553
	***tert*-Butyl alcohol $C_4H_{10}O$**		
C_6H_6	Benzene	74.0	0.378
C_7H_{16}	Heptane	78	0.688
	Methyl propyl ether $C_4H_{10}O$		
C_5H_{12}	Pentane	35.6	0.215
	2-Ethoxyethanol $C_4H_{10}O_2$		
C_7H_{16}	Heptane	96.5	0.153
C_9H_{12}	Propylbenzene	134.6	0.842
	2-Furaldehyde $C_5H_4O_2$		
C_7H_{16}	Heptane	98.3	0.055
C_9H_{12}	Propylbenzene	151.4	0.475
	Pyridine C_5H_5N		
C_7H_8	Toluene	110.1	0.249
	Benzene C_6H_6		
C_6H_{10}	Cyclohexene	78.9	0.635
C_6H_{12}	Cyclohexane	77.6	0.538
	Phenol C_6H_6O		
C_6H_7N	2-Methylpyridine	185.5	0.752
C_7H_9N	2,4-Dimethylpyridine	193.4	0.601
C_9H_{12}	1,3,5-Trimethylbenzene	163.5	0.253
$C_{10}H_{22}$	Decane	168	0.449
	Aniline C_6H_7N		
C_9H_{12}	1,3,5-Trimethylbenzene	164.4	0.150
$C_{10}H_{22}O$	Dipentyl ether	177.5	0.675
$C_{12}H_{26}$	Dodecane	180.4	0.821
	2-Methylpyridine C_6H_7N		
C_8H_{18}	Octane	121.1	0.470
	Cyclohexanol $C_6H_{12}O$		
C_8H_{10}	1,2-Dimethylbenzene	143	0.147