

Appendix J

Mass-Transfer Diffusion Coefficients in Binary Systems

Table J.1 Binary mass diffusivities in gases[†]

System	T (K)	$D_{AB}P$ (cm ² atm/s)	$D_{AB}P$ (m ² Pa/s)
Air			
Ammonia	273	0.198	2.006
Aniline	298	0.0726	0.735
Benzene	298	0.0962	0.974
Bromine	293	0.091	0.923
Carbon dioxide	273	0.136	1.378
Carbon disulfide	273	0.0883	0.894
Chlorine	273	0.124	1.256
Diphenyl	491	0.160	1.621
Ethyl acetate	273	0.0709	0.718
Ethanol	298	0.132	1.337
Ethyl ether	293	0.0896	0.908
Iodine	298	0.0834	0.845
Methanol	298	0.162	1.641
Mercury	614	0.473	4.791
Naphthalene	298	0.0611	0.619
Nitrobenzene	298	0.0868	0.879
<i>n</i> -Octane	298	0.0602	0.610
Oxygen	273	0.175	1.773
Propyl acetate	315	0.092	0.932
Sulfur dioxide	273	0.122	1.236
Toluene	298	0.0844	0.855
Water	298	0.260	2.634
Ammonia			
Ethylene	293	0.177	1.793
Argon			
Neon	293	0.329	3.333
Carbon dioxide			
Benzene	318	0.0715	0.724
Carbon disulfide	318	0.0715	0.724
Ethyl acetate	319	0.0666	0.675

(continued)

Table J.1 (Continued)

System	T (K)	$D_{AB}P$ (cm ² atm/s)	$D_{AB}P$ (m ² Pa/s)
Ethanol	273	0.0693	0.702
Ethyl ether	273	0.0541	0.548
Hydrogen	273	0.550	5.572
Methane	273	0.153	1.550
Methanol	298.6	0.105	1.064
Nitrogen	298	0.165	1.672
Nitrous oxide	298	0.117	1.185
Propane	298	0.0863	0.874
Water	298	0.164	1.661
Carbon monoxide			
Ethylene	273	0.151	1.530
Hydrogen	273	0.651	6.595
Nitrogen	288	0.192	1.945
Oxygen	273	0.185	1.874
Helium			
Argon	273	0.641	6.493
Benzene	298	0.384	3.890
Ethanol	298	0.494	5.004
Hydrogen	293	1.64	16.613
Neon	293	1.23	12.460
Water	298	0.908	9.198
Hydrogen			
Ammonia	293	0.849	8.600
Argon	293	0.770	7.800
Benzene	273	0.317	3.211
Ethane	273	0.439	4.447
Methane	273	0.625	6.331
Oxygen	273	0.697	7.061
Water	293	0.850	8.611
Nitrogen			
Ammonia	293	0.241	2.441
Ethylene	298	0.163	1.651
Hydrogen	288	0.743	7.527
Iodine	273	0.070	0.709
Oxygen	273	0.181	1.834
Oxygen			
Ammonia	293	0.253	2.563
Benzene	296	0.0939	0.951
Ethylene	293	0.182	1.844

[†]R. C. Reid and T. K. Sherwood, *The Properties of Gases and Liquids*, McGraw-Hill, New York, 1958, Chapter 8.

Table J.2 Binary mass diffusivities in liquids[†]

Solute A	Solvent B	Temperature (K)	Solute concentration (g mol/L or kg mol/m ³)	Diffusivity (cm ² /s × 10 ⁵ or m ² /s × 10 ⁹)
Chlorine	Water	289	0.12	1.26
Hydrogen chloride	Water	273	9	2.7
		283	2	1.8
			9	3.3
			2.5	2.5
Ammonia	Water	289	0.5	2.44
		278	3.5	1.24
		288	1.0	1.77
Carbon dioxide	Water	283	0	1.46
		293	0	1.77
Sodium chloride	Water	291	0.05	1.26
			0.2	1.21
			1.0	1.24
			3.0	1.36
			5.4	1.54
Methanol	Water	288	0	1.28
Acetic acid	Water	285.5	1.0	0.82
			0.01	0.91
		291	1.0	0.96
Ethanol	Water	283	3.75	0.50
			0.05	0.83
		289	2.0	0.90
<i>n</i> -Butanol	Water	288	0	0.77
Carbon dioxide	Ethanol	290	0	3.2
Chloroform	Ethanol	293	2.0	1.25

[†]R. E. Treybal, *Mass Transfer Operations*, McGraw-Hill, New York, 1955, p. 25.

Table J.3 Binary diffusivities in solids[†]

Solute	Solid	Temperature (K)	Diffusivity (cm ² /s or m ² /s × 10 ⁴)	Diffusivity (ft ² /h)
Helium	Pyrex	293	4.49 × 10 ⁻¹¹	1.74 × 10 ⁻¹⁰
		773	2.00 × 10 ⁻⁸	7.76 × 10 ⁻⁸
Hydrogen	Nickel	358	1.16 × 10 ⁻⁸	4.5 × 10 ⁻⁸
		438	1.05 × 10 ⁻⁷	4.07 × 10 ⁻⁷
Bismuth	Lead	293	1.10 × 10 ⁻¹⁶	4.27 × 10 ⁻¹⁶
Mercury	Lead	293	2.50 × 10 ⁻¹⁵	9.7 × 10 ⁻¹⁵
Antimony	Silver	293	3.51 × 10 ⁻²¹	1.36 × 10 ⁻²⁰
Aluminum	Copper	293	1.30 × 10 ⁻³⁰	5.04 × 10 ⁻³⁰
Cadmium	Copper	293	2.71 × 10 ⁻¹⁵	1.05 × 10 ⁻¹⁴

[†]R. M. Barrer, *Diffusion In and Through Solids*, Macmillan, New York, 1941.