Table 1-1
Physical Properties for Pure Components

Physical Constants

Number	See Note No. → / Compound	Formula	A. Molar mass (molecular weight)	B. Boiling point, °F, 14.696 psia	C. Vapor pressure, psia, 100 °F	C. Freezing point, °F, 14.696 psia	D. Refractive index, n_D, 60 °F	Critical constants: Pressure, psia	Critical constants: Temperature, °F	Critical constants: Volume, ft³/lbm	Number
1	Methane	CH_4	16.043	−258.73	(5000)•	−296.44•	1.00042•	666.4	−116.67	0.0988	1
2	Ethane	C_2H_6	30.070	−127.49	(800)•	−297.04•	1.20971•	706.5	89.92	0.0783	2
3	Propane	C_3H_8	44.097	−43.75	188.64	−305.73•	1.29480•	616.0	206.06	0.0727	3
4	Isobutane	C_4H_{10}	58.123	10.78	72.581	−255.28	1.3245•	527.9	274.46	0.0714	4
5	n-Butane	C_4H_{10}	58.123	31.08	51.706	−217.05	1.33588•	550.6	305.62	0.0703	5
6	Isopentane	C_5H_{12}	72.150	82.12	20.445	−255.82	1.35631	490.4	369.10	0.0679	6
7	n-Pentane	C_5H_{12}	72.150	96.92	15.574	−201.51	1.35992	488.6	385.8	0.0675	7
8	Neopentane	C_5H_{12}	72.150	49.10	36.69	2.17	1.342•	464.0	321.13	0.0673	8
9	n-Hexane	C_6H_{14}	86.177	155.72	4.9597	−139.58	1.37708	436.9	453.6	0.0688	9
10	2-Methylpentane	C_6H_{14}	86.177	140.47	6.769	−244.62	1.37387	436.6	435.83	0.0682	10
11	3-Methylpentane	C_6H_{14}	86.177	145.89	6.103	———	1.37888	453.1	448.4	0.0682	11
12	Neohexane	C_6H_{14}	86.177	121.52	9.859	−147.72	1.37126	446.8	420.13	0.0667	12
13	2,3-Dimethylbutane	C_6H_{14}	86.177	136.36	7.406	−199.38	1.37730	453.5	440.29	0.0665	13
14	n-Heptane	C_7H_{16}	100.204	209.16	1.620	−131.05	1.38989	396.8	512.7	0.0691	14
15	2-Methylhexane	C_7H_{16}	100.204	194.09	2.272	−180.89	1.38714	396.5	495.00	0.0673	15
16	3-Methylhexane	C_7H_{16}	100.204	197.33	2.131	———	1.39091	408.1	503.80	0.0646	16
17	3-Ethylpentane	C_7H_{16}	100.204	200.25	2.013	−181.48	1.39586	419.3	513.39	0.0665	17
18	2,2-Dimethylpentane	C_7H_{16}	100.204	174.54	3.494	−190.86	1.38446	402.2	477.23	0.0665	18
19	2,4-Dimethylpentane	C_7H_{16}	100.204	176.89	3.293	−182.63	1.38379	396.9	475.95	0.0668	19
20	3,3-Dimethylpentane	C_7H_{16}	100.204	186.91	2.774	−210.01	1.38564	427.2	505.87	0.0662	20
21	Triptane	C_7H_{16}	100.204	177.58	3.375	−12.81	1.39168	428.4	496.44	0.0636	21
22	n-Octane	C_8H_{18}	114.231	258.21	0.53694	−70.18	1.39956	360.7	564.22	0.0690	22
23	Diisobutyl	C_8H_{18}	114.231	228.39	1.102	−132.11	1.39461	360.6	530.44	0.0676	23
24	Isooctane	C_8H_{18}	114.231	210.63	1.709	−161.27	1.38624	372.4	519.46	0.0656	24
25	n-Nonane	C_9H_{20}	128.258	303.47	0.17953	−64.28	1.40746	331.8	610.68	0.0684	25
26	n-Decane	$C_{10}H_{22}$	142.285	345.48	0.06088	−21.36	1.41385	305.2	652.0	0.0679	26
27	Cyclopentane	C_5H_{10}	70.134	120.65	9.915	−136.91	1.40896	653.8	461.2	0.0594	27
28	Methylcyclopentane	C_6H_{12}	84.161	161.25	4.503	−224.40	1.41210	548.9	499.35	0.0607	28
29	Cyclohexane	C_6H_{12}	84.161	177.29	3.266	43.77	1.42862	590.8	536.6	0.0586	29
30	Methylcyclohexane	C_7H_{14}	98.188	213.68	1.609	−195.87	1.42538	503.5	570.27	0.0600	30
31	Ethene(Ethylene)	C_2H_4	28.054	−154.73	(1400)•	−272.47•	(1.228)•	731.0	48.54	0.0746	31
32	Propene(Propylene)	C_3H_6	42.081	−53.84	227.7	−301.45•	1.3130•	668.6	197.17	0.0689	32
33	1-Butene(Butylene)	C_4H_8	56.108	20.79	62.10	−301.63•	1.3494•	583.5	295.48	0.0685	33
34	cis-2-Butene	C_4H_8	56.108	38.69	45.95	−218.06	1.3665•	612.1	324.37	0.0668	34
35	trans-2-Butene	C_4H_8	56.108	33.58	49.87	−157.96	1.3563•	587.4	311.86	0.0679	35
36	Isobutene	C_4H_8	56.108	19.59	63.02	−220.65	1.3512•	580.2	292.55	0.0682	36
37	1-Pentene	C_5H_{10}	70.134	85.93	19.12	−265.39	1.37426	511.8	376.93	0.0676	37
38	1,2-Butadiene	C_4H_6	54.092	51.53	36.53	−213.16	———	(653.)•	(340.)•	(0.065)•	38
39	1,3-Butadiene	C_4H_6	54.092	24.06	59.46	−164.02	1.3975•	627.5	305.	0.0654	39
40	Isoprene	C_5H_8	68.119	93.31	16.68	−230.73	1.42498	(558.)•	(412.)•	(0.065)•	40
41	Acetylene	C_2H_2	26.038	−120.49•	———	−114.5•	———	890.4	95.34	0.0695	41
42	Benzene	C_6H_6	78.114	176.18	3.225	41.95	1.50396	710.4	552.22	0.0531	42
43	Toluene	C_7H_8	92.141	231.13	1.033	−139.00	1.49942	595.5	605.57	0.0550	43
44	Ethylbenzene	C_8H_{10}	106.167	277.16	0.3716	−138.966	1.49826	523.0	651.29	0.0565	44
45	o-Xylene	C_8H_{10}	106.167	291.97	0.2643	−13.59	1.50767	541.6	674.92	0.0557	45
46	m-Xylene	C_8H_{10}	106.167	282.41	0.3265	−54.18	1.49951	512.9	651.02	0.0567	46
47	p-Xylene	C_8H_{10}	106.167	281.07	0.3424	55.83	1.49810	509.2	649.54	0.0570	47
48	Styrene	C_8H_8	104.152	293.25	0.2582	−23.10	1.54937	587.8	(703.)•	0.0534	48
49	Isopropylbenzene	C_9H_{12}	120.194	306.34	0.1884	−140.814	1.49372	465.4	676.3	0.0572	49
50	Methyl alcohol	CH_4O	32.042	148.44	4.629	−143.79	1.33034	1174.	463.08	0.0590	50
51	Ethyl alcohol	C_2H_6O	46.069	172.90	2.312	−173.4	1.36346	890.1	465.39	0.0581	51
52	Carbon monoxide	CO	28.010	−312.68	———	−337.00•	1.00036•	507.5	−220.43	0.0532	52
53	Carbon dioxide	CO_2	44.010	−109.257•	———	−69.83•	1.00048•	1071.	87.91	0.0344	53
54	Hydrogen sulfide	H_2S	34.08	−76.497	394.59	−121.88•	1.00060•	1300.	212.45	0.0461	54
55	Sulfur dioxide	SO_2	64.06	14.11	85.46	−103.86•	1.00062•	1143.	315.8	0.0305	55
56	Ammonia	NH_3	17.0305	−27.99	211.9	−107.88•	1.00036•	1646.	270.2	0.0681	56
57	Air	N_2+O_2	28.9625	−317.8	———	———	1.00028•	546.9	−221.31	0.0517	57
58	Hydrogen	H_2	2.0159	−422.955•	———	−435.26•	1.00013•	188.1	−399.9	0.5165	58
59	Oxygen	O_2	31.9988	−297.332•	———	−361.820•	1.00027•	731.4	−181.43	0.0367	59
60	Nitrogen	N_2	28.0134	−320.451	———	−346.00•	1.00028•	493.1	−232.51	0.0510	60
61	Chlorine	Cl_2	70.906	−29.13	157.3	−149.73•	1.3878•	1157.	290.75	0.0280	61
62	Water	H_2O	18.0153	212.000•	0.9501	32.00	1.33335	3198.8	705.16	0.0497$_s$	62
63	Helium	He	4.0026	−452.09	———	———	1.00003•	32.99	−450.31	0.2300	63
64	Hydrogen chloride	HCl	36.461	−121.27	906.71	−173.52•	1.00042•	1205.	124.77	0.0356	64

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Table 1-1
Continued

Physical Constants

*See the Table of Notes and References.

Number	E. Density of liquid 14.696 psia, 60°F: Relative density (specific gravity) 60°F/60°F	E. Density of liquid 14.696 psia, 60°F: lbm/gal.	E. Density of liquid 14.696 psia, 60°F: gal./lb mole	F. Temperature coefficient of density, 1/°F	G. Acentric factor, ω	H. Compressibility factor of real gas, Z 14.696 psia, 60°F	I. Ideal gas 14.696 psia, 60°F: Relative density (specific gravity) Air = 1	I. Ideal gas 14.696 psia, 60°F: ft³ gas/lbm	I. Ideal gas 14.696 psia, 60°F: ft³ gas/gal. liquid	J. Specific Heat 60°F 14.696 psia Btu/(lbm·°F): C_p, Ideal gas	J. Specific Heat 60°F 14.696 psia Btu/(lbm·°F): C_p, Liquid	Number
1	(0.3)•	(2.5)•	(6.4172)•	——	0.0104	0.9980	0.5539	23.654	(59.135)•	0.52669	——	1
2	0.35619•	2.9696•	10.126•	——	0.0979	0.9919	1.0382	12.620	37.476•	0.40782	0.97225	2
3	0.50699•	4.2268•	10.433•	−0.00162•	0.1522	0.9825	1.5226	8.6059	36.375•	0.38852	0.61996	3
4	0.56287•	4.6927•	12.386•	−0.00119•	0.1852	0.9711	2.0068	6.5291	30.639•	0.38669	0.57066	4
5	0.58401•	4.8690•	11.937•	−0.00106•	0.1995	0.9667	2.0068	6.5291	31.790•	0.39499	0.57272	5
6	0.62470	5.2082	13.853	−0.00090	0.2280	——	2.4912	5.2596	27.393	0.38440	0.53331	6
7	0.63112	5.2617	13.712	−0.00086	0.2514	——	2.4912	5.2596	27.674	0.38825	0.54363	7
8	0.59666•	4.9744•	14.504•	−0.00106•	0.1963	0.9582	2.4912	5.2596	26.163•	0.39038	0.55021	8
9	0.66383	5.5344	15.571	−0.00075	0.2994	——	2.9755	4.4035	24.371	0.38628	0.53327	9
10	0.65785	5.4846	15.713	−0.00076	0.2780	——	2.9755	4.4035	24.152	0.38526	0.52732	10
11	0.66901	5.5776	15.451	−0.00076	0.2732	——	2.9755	4.4035	24.561	0.37902	0.51876	11
12	0.65385	5.4512	15.809	−0.00076	0.2326	——	2.9755	4.4035	24.005	0.38231	0.51367	12
13	0.66631	5.5551	15.513	−0.00076	0.2469	——	2.9755	4.4035	24.462	0.37762	0.51308	13
14	0.68820	5.7376	17.464	−0.00068	0.3494	——	3.4598	3.7872	21.729	0.38447	0.52802	14
15	0.68310	5.6951	17.595	−0.00070	0.3298	——	3.4598	3.7872	21.568	0.38041	0.52199	15
16	0.69165	5.7664	17.377	−0.00070	0.3232	——	3.4598	3.7872	21.838	0.37882	0.51019	16
17	0.70276	5.8590	17.103	−0.00069	0.3105	——	3.4598	3.7872	22.189	0.38646	0.51410	17
18	0.67829	5.6550	17.720	−0.00070	0.2871	——	3.4598	3.7872	21.416	0.38594	0.51678	18
19	0.67733	5.6470	17.745	−0.00073	0.3026	——	3.4598	3.7872	21.386	0.39414	0.52440	19
20	0.69772	5.8170	17.226	−0.00067	0.2674	——	3.4598	3.7872	22.030	0.38306	0.50138	20
21	0.69457	5.7907	17.304	−0.00068	0.2503	——	3.4598	3.7872	21.930	0.37724	0.49920	21
22	0.70696	5.8940	19.381	−0.00064	0.3977	——	3.9441	3.3220	19.580	0.38331	0.52406	22
23	0.69793	5.8187	19.632	−0.00067	0.3564	——	3.9441	3.3220	19.330	0.37571	0.51130	23
24	0.69624	5.8046	19.679	−0.00065	0.3035	——	3.9441	3.3220	19.283	0.38222	0.48951	24
25	0.72187	6.0183	21.311	−0.00061	0.4445	——	4.4284	2.9588	17.807	0.38246	0.52244	25
26	0.73421	6.1212	23.245	−0.00057	0.4898	——	4.9127	2.6671	16.326	0.38179	0.52103	26
27	0.75050	6.2570	11.209	−0.00073	0.1950	——	2.4215	5.4110	33.856	0.27199	0.42182	27
28	0.75349	6.2819	13.397	−0.00069	0.2302	——	2.9059	4.5090	28.325	0.30100	0.44126	28
29	0.78347	6.5319	12.885	−0.00065	0.2096	——	2.9059	4.5090	29.452	0.28817	0.43584	29
30	0.77400	6.4529	15.216	−0.00062	0.2358	——	3.3902	3.8649	24.940	0.31700	0.44012	30
31	——	——	——	——	0.0865	0.9936	0.9686	13.527	——	0.35697	——	31
32	0.52095•	4.3432•	9.6889•	−0.00173•	0.1356	0.9844	1.4529	9.0179	39.167•	0.35714	0.57116	32
33	0.60107•	5.0112•	11.197•	−0.00112•	0.1941	0.9699	1.9373	6.7636	33.894•	0.35446	0.54533	33
34	0.62717•	5.2288•	10.731•	−0.00105•	0.2029	0.9665	1.9373	6.7636	35.366•	0.33754	0.52980	34
35	0.60996•	5.0853•	11.033•	−0.00106•	0.2128	0.9667	1.9373	6.7636	34.395•	0.35574	0.54215	35
36	0.60040•	5.0056•	11.209•	−0.00117•	0.1999	0.9700	1.9373	6.7636	33.856•	0.37690	0.54839	36
37	0.64571	5.3834	13.028	−0.00089	0.2333	——	2.4215	5.4110	29.129	0.36351	0.51782	37
38	0.65799•	5.4857•	9.8605•	−0.00101•	0.2540	(0.969)	1.8677	7.0156	38.485•	0.34347	0.54029	38
39	0.62723•	5.2293•	10.344•	−0.00110•	0.2007	(0.965)	1.8677	7.0156	36.687•	0.34120	0.53447	39
40	0.68615	5.7205	11.908	−0.00082	0.1568	——	2.3520	5.5710	31.869	0.35072	0.51933	40
41	(0.41796)	(3.4842)	(7.473)	——	0.1949	0.9930	0.8990	14.574	——	0.39754	——	41
42	0.88448	7.3740	10.593	−0.00067	0.2093	——	2.6971	4.8581	35.824	0.24296	0.40989	42
43	0.87190	7.2691	12.676	−0.00059	0.2633	——	3.1814	4.1184	29.937	0.26370	0.40095	43
44	0.87168	7.2673	14.609	−0.00056	0.3027	——	3.6657	3.5744	25.976	0.27792	0.41139	44
45	0.88467	7.3756	14.394	−0.00052	0.3942	——	3.6657	3.5744	26.363	0.28964	0.41620	45
46	0.86875	7.2429	14.658	−0.00053	0.3257	——	3.6657	3.5744	25.889	0.27427	0.40545	46
47	0.86578	7.2181	14.708	−0.00056	0.3216	——	3.6657	3.5744	25.800	0.27471	0.40255	47
48	0.91108	7.5958	13.712	−0.00053	(0.2412)	——	3.5961	3.6435	27.675	0.27110	0.41220	48
49	0.86634	7.2228	16.641	−0.00055	0.3260	——	4.1500	3.1573	22.804	0.29170	0.42053	49
50	0.79626	6.6385	4.8267	−0.00066	0.5649	——	1.1063	11.843	78.622	0.32316	0.59187	50
51	0.79399	6.6196	6.9595	−0.00058	0.6438	——	1.5906	8.2372	54.527	0.33222	0.56610	51
52	0.78939•	6.5812•	4.2561•	——	0.0484	0.9959	0.9671	13.548	89.163•	0.24847	——	52
53	0.81802•	6.8199•	6.4532•	−0.00583•	0.2667	0.9943	1.5196	8.6229	58.807•	0.19911	——	53
54	0.80144•	6.6817•	5.1005•	−0.00157•	0.0948	0.9846	1.1767	11.135	74.401•	0.23827	0.50418	54
55	1.3974•	11.650•	5.4987•	——	0.2548	0.9802	2.2118	5.9238	69.012•	0.14804	0.32460	55
56	0.61832•	5.1550•	3.3037•	——	0.2557	0.9877	0.5880	22.283	114.87•	0.49677	1.1209	56
57	0.87476•	7.2930•	3.9713•	——	——	1.0000	1.0000	13.103	95.557•	0.23988	——	57
58	0.071070•	0.59252•	3.4022•	——	−0.2202	1.0006	0.06960	188.25	111.54•	3.4038	——	58
59	1.1421•	9.5221•	3.3605•	——	0.0216	0.9992	1.1048	11.859	112.93•	0.21892	——	59
60	0.80940•	6.7481•	4.1513•	——	0.0372	0.9997	0.9672	13.546	91.413•	0.24828	——	60
61	1.4244•	11.875•	5.9710•	——	0.0878	(0.9875)	2.4482	5.3519	63.554•	0.11377	——	61
62	1.00000	8.33712	2.1609	−0.00009	0.3443	——	0.62202	21.065	175.62	0.44457	0.99974	62
63	0.12510•	1.0430•	3.8376•	——	0.	1.0006	0.1382	94.814	98.891•	1.2404	——	63
64	0.85129•	7.0973•	5.1373•	−0.00300•	0.1259	0.9923	1.2589	10.408	73.869•	0.19086	——	64

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