COMPONENTS:	EVALUATOR:
(1) Propane; C_3H_8; [74-98-6] Butane; C_4H_{10}; [106-97-8] 2-Methylpropane; C_4H_{10}; [75-28-5] (2) Non-polar solvents excluding alkanes and organohalides, at high pressure	Walter Hayduk Department of Chemical Engineering University of Ottawa Ottawa, Canada K1N 9B4 July, 1984

CRITICAL EVALUATION:

Data for the solubilities at high pressure are available for *propane* in benzene (1,2) and also in 1,2,3,4-tetrahydronaphthalene (tetralin) (3), as well as for the mixed gas, *propane* and *1-propene* in 1,2,3,4-tetrahydronaphthalene (3).

The data of Glanville et al. (1) for the solubilities of *propane* in benzene were tested for consistency by plotting the gas partial pressure versus mole fraction solubility on log scales. Normally extrapolation of such data yields the solubility at 101.325 kPa pressure which checks the solubility measured at the low pressure. Where these checks were possible, the Glanville (1) data appeared too low by more than 10%. They also suggest the unlikely possibility that Henry's law is not obeyed even for relatively low pressures. The early data of Ipatieff et al. (2) (1942) are not complete because the gas phase analysis was not provided. An estimate of the gas composition using Raoult's law for the solvent yields several solubility results which are higher by more than 10% than those of Glanville et al. Because the data of Glanville et al. appear inconsistent and inaccurate, they are classified as doubtful. Because they are incomplete, the data of Ipatieff et al. (2) are simple unclassified.

The solubilities are available for *propane* at two temperatures in 1,2,3,4-tetrahydronaphthalene (tetralin) (3). These data appear consistent and are classified as tentative. Data are also available by the same workers (3) for the solubilities of the gas mixtures, *propane* and *1-propene*, in 1,2,3,4-tetrahydronaphthalene. The gas phase compositions corresponding to the solubilities are not available, however; hence it is not possible to test the consistency of the data. These data are incomplete and are, therefore, not classified.

References

1. Glanville, J.W.; Sage, B.H.; Lacey, W.N. *Ind. Eng. Chem.* 1950, *42*, 508-513.

2. Ipatieff, V.N.; Monroe, G.S. *Ind. Eng. Chem. Anal. Edn.* 1942, *14*, 166-171.

3. Noda, K.; Sakal, M.; Ishida, K. *J. Chem. Eng. Data* 1982, *27*, 32-34.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Benzene; C_6H_6; [71-43-2]	Ipatieff, V. N.; Monroe, G. S. *Ind. Eng. Chem. Anal. Edn.* 1942, *14*, 166-171.
VARIABLES: *T*/K: 423-515 *P*/MPa: 1.1-4.96	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	T/°C	*P*/atm	*P*/MPa	Solubility[a]	Mole fraction of propane $x_{C_3H_8}$
423	150	11.0	1.11	7.41	0.116
		21.0	2.13	22.25	0.2827
433	160	13.0	1.32	7.54	0.118
		24.5	2.48	22.36	0.2837
443	170	15.5	1.57	7.66	0.119
		28.5	2.89	22.50	0.2849
453	180	18.0	1.82	7.77	0.121
		33.0	3.34	22.70	0.2867
463	190	21.0	2.13	7.87	0.122
		38.5	3.90	22.95	0.2890
473	200	24.0	2.43	7.97	0.124
		43.5	4.41	23.24	0.2916
483	210	28.0	2.84	8.07	0.125
		49.0	4.96	23.56	0.2944
423	150	11	1.1	7.41	0.116
383	110	11	1.1	22.12	0.2815
463	190	21	2.1	7.88	0.122
423	150	21	2.1	22.26	0.2828
490	217	31	3.1	8.13	0.126
448	175	31	3.1	22.60	0.2858
515	242	41	4.2	8.32	0.128
468	195	41	4.2	23.08	0.2902

[a] g of propane per 100 g benzene.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Rotating bomb of 3.5 dm^3 capacity. Pressure measured with a Bourdon gauge and temperature measured with thermocouple. Propane in both liquid and gaseous samples determined by stripping out benzene at low temperature and estimating propane volumetrically. Benzene estimated gravimetrically.	1. Phillips Petroleum Co. sample; C.P. grade. 2. Baker C.P. thiophene-free sample n_D^{20} 1.5012.
	ESTIMATED ERROR: $\delta T/K = \pm 0.5$; $\delta x_{C_3H_8} = \pm 3\%$ (estimated by compiler).
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6]	Glanville, J. W.; Sage, B. H.; Lacey, W. N.
(2) Benzene; C_6H_6; [71-43-2]	*Ind. Eng. Chem.* 1950, *42*, 508-513.

EXPERIMENTAL VALUES: (concluded)

T/K (t/°F)	P/psi	P/10^5Pa	Wt. fraction in liquid	Wt. fraction in gas	Mole fraction in liquid, $x_{C_3H_8}$	Mole fraction in gas, $y_{C_3H_8}$
377.59	200	13.79	0.1572	0.7507	0.2484	0.8421
(220)	250	17.23	0.2227	0.7997	0.3367	0.8761
	300	20.68	0.2945	0.8371	0.4251	0.9010
	350	24.47	0.3749	0.8642	0.5151	0.9185
	400	27.58	0.4640	0.8920	0.6052	0.9360
	450	31.04	0.5671	0.9144	0.6988	0.9498
	500	37.91	0.6675	0.9313	0.6675	0.9600
	550	41.37	0.7657	0.9467	0.7657	0.9692
	600	44.81	0.8797	0.9622	0.8797	0.9783
410.93	80	5.52	0.0081	0.1108	0.0143	0.1808
(280)	100	6.89	0.0190	0.2206	0.0332	0.3339
	150	10.34	0.0479	0.3992	0.0818	0.5407
	200	13.79	0.0792	0.5077	0.1322	0.6462
	250	17.23	0.1133	0.5819	0.1846	0.7114
	300	20.68	0.1503	0.6352	0.2386	0.7552
	350	24.47	0.1906	0.6750	0.2944	0.7863
	400	27.58	0.2340	0.7047	0.3511	0.8087
	450	31.04	0.2768	0.7255	0.4040	0.8240
	500	34.47	0.3292	0.7474	0.4650	0.8397
	550	37.91	0.3917	0.7645	0.5328	0.8518
	600	41.37	0.4574	0.7814	0.5989	0.8636
	650	44.81	0.5261	0.7991	0.6629	0.8757
	700	48.94	0.6113	0.8052	0.7358	0.8798
	750	51.71	0.7104	0.8084	0.8129	0.8820
	769	53.02	0.798	0.798	0.875	0.875
444.26	150	10.34	0.0103	0.0923	0.0181	0.1526
(340)	200	13.79	0.0323	0.2332	0.0558	0.3501
	250	17.23	0.0552	0.3304	0.0938	0.4664
	300	20.68	0.0793	0.4030	0.1324	0.5446
	350	24.47	0.1048	0.4588	0.1718	0.6003
	400	27.58	0.1312	0.5022	0.2111	0.6412
	450	31.04	0.1600	0.5362	0.2523	0.6719
	500	34.47	0.1905	0.5650	0.2942	0.6970
	550	37.91	0.2234	0.5848	0.3375	0.7138
	600	41.37	0.2576	0.6042	0.3806	0.7300
	650	44.81	0.2916	0.6185	0.4218	0.7417
	700	48.94	0.3358	0.6266	0.4724	0.7482
	750	51.71	0.3794	0.6278	0.5199	0.7492
	800	55.16	0.4290	0.6227	0.5709	0.7451
	850	58.61	0.4968	0.5773	0.6362	0.7075
	859	59.23	0.549	0.549	0.6831	0.6831
477.59	250	17.23	0.0097	0.0571	0.0171	0.0969
(400)	300	20.68	0.0283	0.1456	0.0491	0.2319
	350	24.47	0.0450	0.2059	0.0770	0.3147
	400	27.58	0.0691	0.2588	0.1162	0.3822
	450	31.04	0.0866	0.3062	0.1438	0.4388
	500	34.47	0.1053	0.3384	0.1725	0.4754
	550	37.91	0.1265	0.3685	0.2042	0.5083
	600	41.37	0.1500	0.3944	0.2382	0.5357
	650	44.81	0.1754	0.4184	0.2737	0.5603
	700	48.94	0.2027	0.4366	0.3105	0.5785
	750	51.71	0.2308	0.4461	0.3470	0.5879
	800	55.16	0.2597	0.4419	0.3832	0.5837
	850	58.61	0.3038	0.4132	0.4359	0.5550
	867	59.78	0.349	0.349	0.487	0.487

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) Benzene; C_6H_6; [71-43-2]	Glanville, J. W.; Sage, B. H.; Lacey, W. N. *Ind. Eng. Chem.* 1950, *42*, 508-513.
VARIABLES: T/K: 310.9-477.6 P/kPa: 138-5978	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K (t/°F)	P/psi	$P/10^5$Pa	Wt. fraction in liquid	Wt. fraction in gas	Mole fraction in liquid, $x_{C_3H_8}$	Mole fraction in gas, $y_{C_3H_8}$
310.93	20	1.38	0.0228	0.7378	0.0397	0.8329
(100)	40	2.76	0.0624	0.8490	0.1055	0.9088
	60	4.14	0.1194	0.9000	0.1937	0.9410
	80	5.52	0.1980	0.9310	0.3042	0.9598
	100	6.89	0.3038	0.9505	0.4359	0.9714
	150	10.34	0.6801	0.9831	0.7901	0.9904
344.26	20	1.38	0.0076	0.3046	0.0134	0.4369
(160)	40	2.76	0.0277	0.6114	0.0480	0.7359
	60	4.14	0.0495	0.7420	0.0845	0.8359
	80	5.52	0.0772	0.7980	0.1291	0.8750
	100	6.89	0.1083	0.8280	0.1771	0.8950
	150	10.34	0.2107	0.8780	0.3210	0.9272
	200	13.79	0.3453	0.9172	0.4830	0.9515
	250	17.23	0.5146	0.9481	0.6525	0.9700
	300	20.68	0.7023	0.9727	0.8069	0.9844
	350	24.47	0.8801	0.9903	0.9286	0.9945
377.59	40	2.76	0.0074	0.1670	0.0130	0.2621
(220)	60	4.14	0.0220	0.3596	0.0383	0.4987
	80	5.52	0.0376	0.4772	0.0647	0.6179
	100	6.89	0.0537	0.5573	0.0913	0.6904
	150	10.34	0.1015	0.6792	0.1667	0.7895

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
PVT cell charged with mixture of known composition. Pressure measured with pressure balance. Temperature measured using resistance thermometer. Bubble and dew points determined for various compositions. Co-existing liquid and gas phase properties determined by graphical means. Details in ref. (1).	1. Phillips Petroleum Co., distilled, purity better than 99.9 mole per cent. 2. Commercial pure sample, fractionally crystallised and distilled.
	ESTIMATED ERROR: δT/K = ±0.03; $\delta P/10^5$Pa = ±0.1; $\delta x_{C_3H_8}$, $\delta y_{C_3H_8}$ = ±0.005.
	REFERENCES: 1. Sage, B. H.; Lacey, W. N. *Trans. Inst. Mining Met. Engnrs.* 1940, *136*, 136.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) 1,2,3,4-Tetrahydronaphthalene (tetralin); $C_{10}H_{12}$; [119-64-2]	Noda, K.; Sakal, M.; Ishida, K. *J. Chem. Eng. Data* 1982, *27*, 32-34.
VARIABLES: T/K: 273.15, 293.15 P/kPa: 136-788	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/kPa	Mole fraction of propane in liquid, $x_{C_3H_8}$	T/K	P/kPa	Mole fraction of propane in liquid, $x_{C_3H_8}$
273.15	136	0.1483	293.15	197	0.1329
	153	0.1729		217	0.1479
	170	0.1900		241	0.1658
	211	0.2598		320	0.2236
	222	0.2687		345	0.2503
	234	0.2893		467	0.3703
	299	0.4131		481	0.3881
	304	0.4269		624	0.6115
	358	0.5515		648	0.6408
	382	0.6676		658	0.6689
	391	0.7024		725	0.8273
	400	0.7424		788	0.9411
	423	0.8520			
	450	0.9445			
	456	0.9617			

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static method described in ref. (1). Pyrex glass cell fitted with gas sample port and Bourdon pressure gauge. Composition of liquid phase estimated from known volume of system and amounts added.

SOURCE AND PURITY OF MATERIALS:

1. Research grade from Takachiho Kagaku Kogyo; purity 99.9 volume per cent.
2. Reagent grade, fractionated b.pt. (at 0.8 kPa) 341.05 K.

ESTIMATED ERROR:

δT/K = ±0.02; δP/kPa = ±1;

$\delta x_{C_3H_8}$ = ±0.001.

REFERENCES:

1. Noda, K.; Morisue, T.; Ishida, K.
J. Chem. Eng. Japan
1975, *8*, 104.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Propane; C_3H_8; [74-98-6] (2) 1-Propene; C_3H_6; [115-07-1] (3) 1,2,3,4-Tetrahydronaphthalene (tetralin); $C_{10}H_{12}$; [119-64-2]	Noda, K.; Sakal, M.; Ishida, K. *J. Chem. Eng. Data* 1982, *27*, 32-34.
VARIABLES: T/K: 273.15,293.15 P/kPa: 148-761	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/kPa	Mole fraction of 1-propene, $x_{C_3H_6}$	Mole fraction of propane, $x_{C_3H_8}$	T/K	P/kPa	Mole fraction of 1-propene, $x_{C_3H_6}$	Mole fraction of propane, $x_{C_3H_8}$
273.15	153	0.1379	0.0356	293.15	217	0.1209	0.0300
	148	0.1058	0.0600		210	0.0935	0.0507
	300	0.2972	0.0786		459	0.2686	0.0700
	349	0.3653	0.0985		502	0.3041	0.0786
	260	0.2030	0.1167		394	0.1824	0.1030
	192	0.0974	0.1250		279	0.0866	0.1081
	328	0.2733	0.1593		467	0.2267	0.1282
	179	0.0452	0.1610		259	0.0401	0.1403
	468	0.5899	0.1612		780	0.5548	0.1545
	313	0.1791	0.2348		494	0.1659	0.2180
	334	0.1958	0.2601		492	0.1609	0.2282
	455	0.4666	0.2777		431	0.0703	0.2535
	278	0.0777	0.2809		761	0.4372	0.2653
	339	0.1030	0.3818		513	0.0866	0.3221
	446	0.3279	0.4402		755	0.3119	0.4288
	428	0.1636	0.6071		730	0.1545	0.5894

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static method described in ref. (1). Pyrex glass cell fitted with gas sample port and Bourdon pressure gauge. Composition of liquid phase estimated from known volume of system and amounts added. Gas sample analysed by GC.

SOURCE AND PURITY OF MATERIALS:

1 and 2. Research grade from Takachiho Kagaku Kogyo; purities 99.9 and 99.7 volume per cent, respectively.

3. Reagent grade, fractionated b.pt. (at 0.8 kPa) 341.05 K.

ESTIMATED ERROR:

δT/K = ±0.02; δP/kPa = ±1;

$\delta x_{C_3H_8}$, $\delta x_{C_3H_6}$ = ±0.001.

REFERENCES.

1. Noda, K.; Morisue, T.; Ishida, K.
J. Chem. Eng. Japan
1975, *8*, 104.