COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. Ethane; C_2H_6; [74-84-0] 3. Propane; C_3H_8; [74-98-6] 4. Methylbenzene; C_7H_8; [108-88-3] 5. 1-Methylnaphthalene; $C_{11}H_{10}$; [90-12-0]	Li, Y.-H.; Dillard, K. H.; Robinson, R. L. *J. Chem. Eng. Data* 1981, *26*, 200-204.
VARIABLES: Temperature	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K (T/°F)	P/MPa (p/psia)	Phase	Mole fractions x_{CH_4}	$x_{C_2H_6}$	$x_{C_3H_8}$	$x_{C_7H_8}$	$x_{C_{11}H_{10}}$
377.6 (220)	1.38 (200)	gas	0.6625	0.1805	0.1150	0.04155	0.0004620
		liquid	0.01380	0.01455	0.02195	0.5575	0.3920
	2.76 (400)	gas	0.7100	0.1670	0.09505	0.02470	0.0003350
		liquid	0.03055	0.02765	0.03595	0.5365	0.3695
	4.14 (600)	gas	0.7415	0.1590	0.08045	0.01905	0.0003170
		liquid	0.05030	0.03945	0.04460	0.5155	0.3500
	5.52 (800)	gas	0.7575	0.1520	0.07325	0.01695	0.0003645
		liquid	0.06940	0.04810	0.05090	0.4910	0.3405
	6.89 (1000)	gas	0.7695	0.1450	0.06875	0.01650	0.0003555
		liquid	0.08745	0.05390	0.05270	0.4820	0.3240
	8.62 (1250)	gas	0.7845	0.1360	0.06260	0.01615	0.0003990
		liquid	0.1115	0.06030	0.05565	0.4635	0.3090
	10.34 (1500)	gas	0.7940	0.1295	0.05885	0.01680	0.0004290
		liquid	0.1355	0.06535	0.05735	0.4460	0.2960
	12.07 (1750)	gas	0.8030	0.1230	0.05535	0.01780	0.0005140
		liquid	0.1560	0.06855	0.05770	0.4275	0.2900
	13.79 (2000)	gas	0.8085	0.1190	0.05285	0.01910	0.0005610
		liquid	0.1755	0.07190	0.05855	0.4120	0.2820

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Variable volume, windowed phase equilibrium cell was used in which the mixture was confined by a floating piston. Pressure was measured with a Bourdon pressure gauge. Temperature was measured with a platinum resistance thermometer. Samples of vapor and liquid phases analysed by GC using a thermal conductivity detector. Details in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1, 2, 3. Linde samples, purities 99.97, 99.0 and 99.5 mole per cent, respectively.

4. Phillips Petroleum Co. sample, purity better than 97.8 mole per cent.

5. Aldrich Chemical Co. sample, purity better than 97 mole per cent.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta P/MPa = \pm 2\%$; $\delta x = \pm 2\%$ or 0.0001 (whichever is greater) (estimated by compiler).

REFERENCES:

1. Li, Y.-H.; Dillard, K. H.; Robinson, R. L.
J. Chem. Eng. Data
1981, *26*, 53.

COMPONENTS:

1. Methane; CH_4; [74-82-8]
2. Ethane; C_2H_6; [74-84-0]
3. Propane; C_3H_8; [74-98-6]
4. Methylbenzene; C_7H_8; [108-88-3]
5. 1-Methylnaphthalene; $C_{11}H_{10}$; [90-12-0]

ORIGINAL MEASUREMENTS:

Li, Y.-H.; Dillard, K. H.; Robinson, R. L.

J. Chem. Eng. Data

1981, *26*, 200-204.

EXPERIMENTAL VALUES:

T/K (T/°F)	P/MPa p/psia	Phase	Mole fractions x_{CH_4}	$x_{C_2H_6}$	$x_{C_3H_8}$	$x_{C_7H_8}$	$x_{C_{11}H_{10}}$
410.9	1.65 (239)	gas	0.6350	0.1670	0.1110	0.08185	0.001885
		liquid	0.01615	0.01410	0.01985	0.5730	0.3770
	3.03 (439)	gas	0.6795	0.1665	0.09930	0.05335	0.001360
		liquid	0.03330	0.02510	0.03105	0.5580	0.3525
	4.41 (640)	gas	0.7050	0.1610	0.09015	0.04265	0.001025
		liquid	0.05150	0.03420	0.03835	0.5425	0.3335
	5.78 (839)	gas	0.7240	0.1545	0.08255	0.03810	0.001030
		liquid	0.06905	0.04150	0.04330	0.5240	0.3225
	7.14 (1035)	gas	0.7380	0.1480	0.07655	0.03640	0.001170
		liquid	0.08810	0.04770	0.04680	0.5050	0.3125
	8.91 (1292)	gas	0.7510	0.1415	0.07155	0.03470	0.001200
		liquid	0.1165	0.05655	0.05100	0.4285	0.2975
	10.63 (1542)	gas	0.7650	0.1340	0.06620	0.03335	0.001310
		liquid	0.1415	0.06360	0.05470	0.4560	0.2845
	12.36 (1792)	gas	0.7745	0.1280	0.06185	0.03410	0.001515
		liquid	0.1610	0.06665	0.05530	0.4405	0.2765
	14.09 (2043)	gas	0.7810	0.1235	0.05980	0.03455	0.001565
		liquid	0.1855	0.07040	0.05620	0.4250	0.2630
444.3	1.41 (204)	gas	0.5565	0.1480	0.1035	0.1855	0.006925
		liquid	0.01230	0.008945	0.01200	0.5235	0.4435
	2.63 (381)	gas	0.6280	0.1550	0.09995	0.1125	0.004590
		liquid	0.02675	0.01770	0.02160	0.5355	0.3985
	4.07 (591)	gas	0.6640	0.1545	0.09460	0.08280	0.003730
		liquid	0.04575	0.02720	0.03095	0.5235	0.3725
	5.47 (793)	gas	0.6870	0.1510	0.08840	0.07035	0.003280
		liquid	0.06125	0.03375	0.03660	0.5140	0.3545
	6.87 (996)	gas	0.7080	0.1455	0.08215	0.06145	0.003050
		liquid	0.08120	0.04075	0.04070	0.4980	0.3395
	8.58 (1244)	gas	0.7210	0.1405	0.07715	0.05830	0.003205
		liquid	0.1050	0.04775	0.04495	0.4775	0.3250
	10.35 (1501)	gas	0.7355	0.1350	0.07220	0.05455	0.003025
		liquid	0.1335	0.05475	0.04890	0.4595	0.3035
	12.01 (1742)	gas	0.7445	0.1300	0.06840	0.05380	0.003190
		liquid	0.1535	0.05960	0.05075	0.4440	0.2915
	13.64 (1978)	gas	0.7495	0.1260	0.06550	0.05535	0.003725
		liquid	0.1695	0.06220	0.05155	0.4335	0.2830
477.6 (400)	1.43 (207)	gas	0.4925	0.1305	0.08890	0.2700	0.01810
		liquid	0.009990	0.006505	0.008065	0.4305	0.5450
	2.75 (399)	gas	0.5715	0.1455	0.09450	0.1780	0.01045
		liquid	0.02390	0.01445	0.01625	0.5070	0.4385
	4.21 (611)	gas	0.6150	0.1490	0.09255	0.1350	0.008365
		liquid	0.04250	0.02350	0.02495	0.5105	0.3985
	5.56 (806)	gas	0.6390	0.1480	0.08900	0.1165	0.007335
		liquid	0.05910	0.03030	0.03050	0.5080	0.3720

(cont.)

COMPONENTS:

1. Methane; CH_4; [74-82-8]
2. Ethane; C_2H_6; [74-84-0]
3. Propane; C_3H_8; [74-98-6]
4. Methylbenzene; C_7H_8; [108-88-3]
5. 1-Methylnaphthalene; $C_{11}H_{10}$; [90-12-0]

ORIGINAL MEASUREMENTS:

Li, Y.-H.; Dillard, K. H.; Robinson, R. L.

J. Chem. Eng. Data

1981, *26*, 200-204.

EXPERIMENTAL VALUES:

T/K (T/°F)	P/MPa p/psia	Phase	Mole fractions x_{CH_4}	$x_{C_2H_6}$	$x_{C_3H_8}$	$x_{C_7H_8}$	$x_{C_{11}H_{10}}$
477.6	7.03	gas	0.6605	0.1455	0.08440	0.1030	0.006690
(400)	(1019)	liquid	0.07470	0.03685	0.03505	0.5015	0.3520
	8.69	gas	0.6785	0.1405	0.07900	0.09510	0.006885
	(1261)	liquid	0.09955	0.04400	0.03955	0.4820	0.3345
	10.29	gas	0.6890	0.1370	0.07535	0.09155	0.006990
	(1493)	liquid	0.1245	0.05060	0.04325	0.4670	0.3150
	12.18	gas	0.6700	0.1325	0.07130	0.08915	0.007310
	(1766)	liquid	0.1480	0.5585	0.04535	0.4515	0.2995
	13.65	gas	0.7030	0.1290	0.06865	0.09115	0.008305
	(1980)	liquid	0.1720	0.06100	0.04825	0.4330	0.2860

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. Propane; C_3H_8; [74-98-6] 3. Methylbenzene; C_7H_8; [108-88-3]	Van Horn, L. D.; Kobayashi, R. *J. Chem. Engng. Data* 1967, *12*, 294-303.
VARIABLES: Temperature, pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K (T/°F)	P/MPa (P/psi)	Mole fractions in liquid x_{CH_4}	$x_{C_3H_8}$	$x_{C_7H_8}$	in vapor y_{CH_4}	$y_{C_3H_8}$
(233.15)	0.689	0.030	0.245	0.725	0.9233	0.0767
-40	(100)	0.044	0.558	0.398	0.869	0.131
	1.38	0.052	0.101	0.847	0.9784	0.0216
	(200)	0.056	0.142	0.802	0.9713	0.0287
		0.062	0.222	0.716	0.9595	0.0405
		0.109	0.661	0.230	0.9233	0.0767
	2.76	0.117	0.167	0.716	0.9784	0.0216
	(400)	0.135	0.247	0.618	0.9713	0.0287
		0.168	0.444	0.388	0.9595	0.0405
	4.14	0.145	0.080	0.775	0.9894	0.0106
	(600)	0.175	0.191	0.634	0.9784	0.0216
		0.216	0.290	0.494	0.9713	0.0287
	5.52	0.182	0.076	0.742	0.9894	0.0106
	(800)	0.234	0.176	0.590	0.9784	0.0216
		0.278	0.260	0.462	0.9713	0.0287
	6.89	0.250	0.143	0.607	0.9784	0.0216
	(1000)					

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The solubilities were determined by measurement of retention volumes using gas chromatography. The method uses methane as carrier gas, propane as an injected solute and toluene as the stationary phase. The technique is described in the source and in ref. (1).

SOURCE AND PURITY OF MATERIALS:

1 and 2. Major impurities were carbon dioxide and nitrogen amounting to about 0.2 mole per cent.

3. Research grade.

ESTIMATED ERROR:

$\delta T/K = \pm 0.05$; $\delta P/psi = \pm 1$, $P \leq$ 1,000 psia; ± 2, $P \geq$ 1,000 psia; δx, $\delta y = \pm 1.5\%$.

REFERENCES:

1. Koonce, K. T.
Ph.D. thesis, Rice University, Houston, 1963.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. Hydrocarbon oil	Sage, B. H.; Backus, H. S.; Lacey, W. N. *Ind. Eng. Chem.* 1935, *27*, 686-690.
VARIABLES: Temperature, pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/°F	T/K	P/psia	P/MPa	Solubility, S /wt-%
70.0	294.3	200	1.38	0.36
		400	2.76	0.83
		600	4.14	1.10
		800	5.52	1.48
		1000	6.89	1.88
		1250	8.62	2.40
		1500	10.34	2.93
		1750	12.07	3.50
		2000	13.79	4.14
		2250	15.51	4.86
100.0	311.0	200	1.38	0.35
		400	2.76	0.79
		600	4.14	1.06
		800	5.52	1.42
		1000	6.89	1.79
		1250	8.62	2.27
		1500	10.34	2.78
		1750	12.07	3.32
		2000	13.79	3.92
		2250	15.51	4.54
		2500	17.24	5.22

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Contents of variable volume cell brought to equilibrium at desired temperature and pressure and volume determined. Volume varied by admission or removal of mercury. Bubble point determined from change in slope of pressure-volume curve.

SOURCE AND PURITY OF MATERIALS:

1. Natural gas sample which was treated for removal of nitrogen, ethane and higher hydrocarbons. Final purity about 99.8 mole per cent.
2. Non-waxy asphalt crude oil with molecular weight of between 335 & 340 (by freezing point depression).

ESTIMATED ERROR:

$\delta T/K = \pm 0.13$; $\delta P/psia = \pm 1$;
$\delta S/S = \pm 0.001$.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8]	Sage, B. H.; Backus, H. S.; Lacey, W. N.
2. Hydrocarbon oil	*Ind. Eng. Chem.* 1935, *27*, 686-690.

EXPERIMENTAL VALUES:

T/°F	T/K	P/psia	P/MPa	Solubility, /wt-%
130.0	327.6	200	1.38	0.34
		400	2.76	0.75
		600	4.14	1.02
		800	5.52	1.36
		1000	6.89	1.72
		1250	8.62	2.17
		1500	10.34	2.65
		1750	12.07	3.15
		2000	13.79	3.69
		2250	15.51	4.26
		2500	17.24	4.88
		2750	18.96	5.4 *
160.0	344.3	200	1.38	0.33
		400	2.76	0.73
		600	4.14	0.98
		800	5.52	1.31
		1000	6.89	1.66
		1250	8.62	2.09
		1500	10.34	2.54
		1750	12.07	3.01
		2000	13.79	3.51
		2250	15.51	4.03
		2500	17.24	4.59
		2750	18.96	5.20
		3000	20.68	5.8 *
190.0	361.0	200	1.38	0.31
		400	2.76	0.70
		600	4.14	0.94
		800	5.52	1.27
		1000	6.89	1.62
		1250	8.62	2.01
		1500	10.34	2.44
		1750	12.07	2.88
		2000	13.79	3.35
		2250	15.51	3.83
		2500	17.24	4.35
		2750	18.96	4.90
		3000	20.68	5.5 *
220.0	377.6	200	1.38	0.30
		400	2.76	0.67
		600	4.14	0.91
		800	5.52	1.23
		1000	6.89	1.05
		1250	8.62	1.94
		1500	10.34	2.35
		1750	12.07	2.77
		2000	13.79	3.21
		2250	15.51	3.66
		2500	17.24	4.31
		2750	18.96	4.64
		3000	20.68	5.16

* extrapolated values.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. Hydrocarbon Blend (Heavy Naphtha)	Frolich, P.K.; Tauch, E.J.; Hogan, J.J.; Peer, A.A. *Ind. Eng. Chem.* 1931, *23*, 548-550
VARIABLES: Pressure	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	P/atm	P/MPa	Solubility, S^*
298.15	10	1.0	6
	20	2.0	12
	30	3.0	18
	40	4.1	23
	50	5.1	28
	60	6.1	33
	70	7.1	39
	80	8.1	45

* Volume of gas measured at 101.325 kPa pressure and 298.15 K dissolved by unit volume of liquid measured under the same conditions.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Liquid saturated with gas and after equilibrium established samples removed and analysed by volumetric method. Allowance was made for the vapor pressure of the liquid and the solubility of the gas at atmospheric pressure. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Methane was of the highest purity available.
2. Density of 0.8003g cm^{-3} and vapor pressure of 80 mmHg at 298.15 K.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 5\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH ; [74-82-8] 2. Hydrocarbon Blend (Gas Oil)	Frolich, P.K.; Tauch, E.J.; Hogan, J.J.; Peer, A.A. *Ind. Eng. Chem.* 1931, *23*, 548-550.
VARIABLES: Pressure	PREPARED BY: C.L. Young

EXPERIMENTAL VALUES:

T/K	P/atm	P/MPa	Solubility, S^*
298.15	10	1.0	4
	20	2.0	8
	30	3.0	12
	40	4.1	16
	50	5.1	20
	60	6.1	24
	70	7.1	29
	80	8.1	34
	90	9.1	39
	100	10.1	44
	110	11.1	49
	120	12.2	54
	130	13.2	59
	140	14.2	64

* Volume of gas measured at 101.325 kPa pressure and 298.15 K dissolved by unit volume of liquid measured under the same conditions.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static equilibrium cell. Liquid saturated with gas and after equilibrium established samples removed and analysed by volumetric method. Allowance was made for the vapor pressure of the liquid and the solubility of the gas at atmospheric pressure. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. Methane was of the highest purity available.
2. Density of 0.8319 g cm^{-3} and vapor pressure of 2 mmHg at 298.15 K.

ESTIMATED ERROR:

$\delta T/K = \pm 0.1$; $\delta S = \pm 5\%$

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. Coal Liquids - Distillate from Exxon Donor Solvent Process	Lin, H.-M.; Sebastian, H. M.; Simnick, J. J.; Chao, K.-C. *Ind. Eng. Chem. Process. Des. Dev.* 1981, *20*, 253-256.
VARIABLES: Temperature, pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/atm	P/MPa	Mole fraction of methane in liquid, x_{CH}	Solubility#, S
		Sample 1		
188.9	49.6	5.03	0.0926	106.06
189.0	99.5	10.08	0.1828	232.50
188.5	149.2	15.12	0.2646	373.96
189.0	198.3	20.09	0.3375	529.62
188.7	245.9	24.92	0.4049	707.30
268.1	48.9	4.95	0.1001	115.63
268.0	99.5	10.08	0.2010	261.52
268.0	146.7	14.86	0.2867	417.87
268.1	196.9	19.95	0.3617	589.08
267.9	243.9	24.71	0.4438	829.41
		Sample 2		
189.1	50.1	5.08	0.0958	93.190
189.0	100.1	10.14	0.1708	181.31
189.2	150.4	15.24	0.2333	267.78
189.1	198.3	20.09	0.2932	365.04
189.3	251.7	25.50	0.3542	482.68
271.0	49.1	4.98	0.0882	85.12
270.9	99.5	10.08	0.1718	182.61
271.0	149.3	15.13	0.2484	290.80
271.0	199.3	20.19	0.3178	409.99

#10^4 × g of methane/g of methane-free oil. (cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Flow apparatus with both liquid and gaseous components continually passing into a mixing tube and then into a cell in which phases separated under gravity. Liquid sample removed from bottom of cell. Volume of vapor kept extremely small so that liquid composition did not change significantly. Composition of liquid sample found by stripping out gas. Details in source and ref. (1).	1. Matheson sample, purity better than 99 mole per cent. 2. See experimental values.
	ESTIMATED ERROR: $\delta T/K = \pm 0.05$; $\delta P/MPa = \pm 0.1\%$ or 0.03 (whichever is greater); $\delta S = \pm 2\%$.
	REFERENCES: 1. Simnick, J. J.; Lawson, C. C.; Lin, H.-M.; Chao, K.-C. *Am. Inst. Chem. Eng. J.* 1977, *23*, 469.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8]	Lin, H.-M.; Sebastian, H. M.; Simnick. J. J.; Chao, K.-C.
2. Coal Liquids - Distillate from Exxon Donor Solvent Process	*Ind. Eng. Chem. Process. Des. Dev.* 1981, *20*, 253-256.

EXPERIMENTAL VALUES:

Details of samples

	Sample 1	Sample 2
Fraction boiling range	400-450 °F	500-600°F
Elemental analyses, wt-%		
C	89.09	89.57
H	9.65	10.35
N	0.06	0.13
O	0.65	0.57
S	0.05	0.19
sp gr at 60 °F	0.9320	0.9844
GC distillation		
wt-% distilled at °F		
1	356.7	465.6
5	376.0	485.5
10	388.2	497.6
20	395.2	513.0
30	399.8	523.3
40	404.2	534.6
50	409.5	545.6
60	416.8	553.0
70	426.7	563.3
80	436.5	579.8
90	446.8	595.7
95	453.1	607.4
99	467.8	632.3
100	494.7	666.6
compound type analyses		
(wt-% by MS)		
total saturates	28.22	26.91
paraffins	1.88	3.20
total aromatics	71.78	73.09
approximate molecular weight	154.34	182.30
Saybolt viscosity at 100 °F s	27.5	556.9
Saybolt viscosity at 210 °F s	12.6	9.6

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. Coal Liquid - Distillate from Solvent Refined Coal Process II	Lin, H.-M.; Sebastian, H. M.; Simnick, J. J.; Chao, K.-C. *Ind. Eng. Chem. Process. Des. Dev.* 1981, *20*, 253-256.
VARIABLES: Pressure	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

T/K	P/atm	P/MPa	Mole fraction of methane in liquid, x_{CH_4}	Solubility#, S
		Sample 1		
269.7	50.1	5.08	0.0933	90.673
269.7	51.0	5.17	0.0949	92.380
269.7	100.7	10.20	0.2050	227.26
269.9	147.6	14.96	0.2933	365.89
269.8	247.3	25.06	0.3974	581.37
		Sample 2		
270.3	51.2	5.19	0.0884	73.402
270.4	99.6	10.09	0.1672	151.93
270.1	150.7	15.27	0.2418	241.29
270.7	239.8	24.30	0.3668	438.35

10^4 × g of methane/g of methane-free oil.

(cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Flow apparatus with both liquid and gaseous components continually passing into a mixing tube and then into a cell in which phases separated under gravity. Liquid sample removed from bottom of cell. Volume of vapor kept extremely small so that liquid composition did not change significantly. Composition of liquid sample found by stripping out gas. Details in source and ref. (1).	1. Matheson sample, purity better than 99 mole per cent. 2. See experimental values.
	ESTIMATED ERROR: $\delta T/K = \pm 0.05$; $\delta P/MPa = \pm 0.1\%$ or 0.03 (whichever is greater); $\delta S = \pm 2\%$.
	REFERENCES: 1. Simnick, J. J.; Lawson, C. C.; Lin, H.-M.; Chao, K.-C. *Am. Inst. Chem. Eng. J.* 1977, *23*, 469.

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8]	Lin, H.-M.; Sebastian, H. M.; Simnick, J. J.; Chao, K.-C.
2. Coal Liquid - Distillate from Solvent Refined Coal Process II	*Ind. Eng. Chem. Process. Des. Dev.* 1981, *20*, 253-256.

EXPERIMENTAL VALUES:

Details of samples

	Sample 1	Sample 2
Boiling range/°F	500-528	600-632
specific gravity, 60/60°F	0.9826	1.0306
molecular weight, ASTM D 2503	182	212
viscosity, SUS,		
cSt at 100 °F	41.8 (4.82)	74.3 (14.20)
210 °F	-(1.27)	33.5 (2.19)
250 °F	-(0.96)	-(1.53)
distillation, ASTM D 86		
over point, °F	436	566
end point, °F	580	672
5% cond. at °F	452	576
10	456	578
20	462	580
30	470	586
40	476	592
50	484	598
60	492	606
70	502	612
80	516	622
90	536	638
95	558	660
recovery, %	98.0	98.0
residue, %	1.0	1.0
loss, %	1.0	1.0

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. Creosote oil	Henson, B.J.; Tarrer, A. R.; Curtis, C. W.; Guln, J. A. *Ind. Eng. Chem. Process Des. Dev.* 1982, *21*, 575-579.
VARIABLES:	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

t/°C	T/K	P/MPa	Solubility, S g CH_4/g creosote oil
30	303	5.6	0.0062
		8.8	0.0099
100	373	6.6	0.0065
		7.0	0.0063
		13.7	0.0129
		14.0	0.0135
		20.4	0.0191
		20.8	0.0192
200	473	7.5	0.0088
		8.0	0.0091
		15.2	0.0167
		15.3	0.0177
		20.9	0.0233
		21.6	0.0235
300	573	8.6	0.0110
		9.3	0.0120
		13.3	0.0171
		13.7	0.0171
		20.8	0.0264
		22.0	0.0268
400	673	7.5	0.0101
		7.8	0.0110
		14.2	0.0204
		14.6	0.0204
		21.3	0.0303
		22.1	0.0305

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

One gallon static equilibrium cell fitted with magnetic agigator. Samples taken from small volume sample loops through which equilibrium liquid was circulated. Gas in liquid sample as estimated by volumetric technique using a Toffel pump.

SOURCE AND PURITY OF MATERIALS:

1. Matheson sample, purity 99 mole per cent.
2. Produced from Kentucky No. 9 coal. Elemental analysis % C 91.5 ± 0.7; H 6.4 ± 0.05; N 1.05 ± 0.31; S 0.53 ± 0.02.

ESTIMATED ERROR:

$\delta T/K = \pm 1$; $\delta S = \pm 4\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. SRC recycle solvent	Henson, B. J.; Tarrer, A. R.; Curtis, C. W.; Guln, J. A. *Ind. Eng. Chem. Process Des. Dev.* 1982, *21*, 575-579.
VARIABLES:	PREPARED BY: C. L. Young

EXPERIMENTAL VALUES:

t/°C	T/K	P/MPa	Solubility, S g CH_4/g recycle oil
100	373	5.4	0.0077
		5.6	0.0079
		11.4	0.0164
		12.0	0.0171
		16.2	0.0227
		16.2	0.0229
		18.8	0.0264
		19.4	0.0267
200	473	6.6	0.0095
		6.7	0.0101
		13.3	0.0194
		13.7	0.0209
		19.4	0.0282
		19.9	0.0300
		20.4	0.0308
300	573	6.0	0.0114
		6.7	0.0104
		14.0	0.0222
		14.5	0.0233
		20.0	0.0326
		20.3	0.0329
400	673	6.7	0.0112
		7.2	0.0119
		14.2	0.0238
		14.6	0.0247
		19.7	0.0335
		20.5	0.0349

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

One gallon static equilibrium cell fitted with magnetic agigator. Samples taken from small volume sample loops through which equilibrium liquid was circulated. Gas in liquid sample as estimated by volumetric technique using a Toffel pump.

SOURCE AND PURITY OF MATERIALS:

1. Matheson sample, purity 99 mole per cent.
2. Produced from Kentucky No. 9 coal. Elemental analysys % C 88.2 ± 0.2; H 8.57 ± 0.12; N 0.49 ± 0.15; S 0.33 ± 0.03.

ESTIMATED ERROR:

$\delta T/K = \pm 1$; $\delta S = \pm 4\%$ (estimated by compiler).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
1. Methane; CH_4; [74-82-8] 2. Santowax R	Grove, N. H.; Whitley, F. J.; Woolmer, R. N. *J. Appl. Chem.* 1960, *10*, 101-109.
VARIABLES:	PREPARED BY:
Temperature, pressure	C. L. Young

EXPERIMENTAL VALUES:

T/K	$P/10^5$Pa	Solubility*	Ostwald coefficient, L
510	1.59	10.7	0.269
510	2.33	13.0	0.222
514	3.68	24.3	0.265
595	4.29	30.0	0.302
604	1.92	14.7	0.333
608	2.73	20.0	0.319
680	3.13	23.0	0.332
680	4.89	39.3	0.363
684	2.17	18.3	0.382

* moles of methane per Mg of Santowax R

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Static cell with null pressure transducer. Pressure measured with Bourdon gauge. Temperature measured with thermocouple. Sample placed in cell and gas added at room temperature. Pressures on both sides of transducer kept approximately equal. Details in source.

SOURCE AND PURITY OF MATERIALS:

1. No details given.
2. Analysis by infra-red method showed sample to be 11.8% o-terphenyl, 56.3% m-terphenyl, 29.3% p-terphenyl, 2.6% diphenyl and higher polyphenyls. Obtained from Monsanto Chemicals Ltd.

ESTIMATED ERROR:

$\delta T/K = \pm 1$; $\delta P/10^5\text{Pa} = \pm 0.01$;
$\delta L_{CH_4} = \pm 10\%$.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Petroleum	Gniewosz, S.; Walfisz, A. *Z. Phys. Chem.* 1887, *1*, 70 - 72.
VARIABLES: T/K = 283.15, 293.15 p/kPa = 101 ("atmospheric")	**PREPARED BY:** M. E. Derrick H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Bunsen Coefficient α/cm^3(STP)cm^{-3}atm^{-1}	Ostwald Coefficient L/cm^3 cm^{-3}
10	283.15	0.143	
		0.142	
		0.146	
		0.144 Av.	0.149
20	293.15	0.129	
		0.134	
		0.131	
		0.131 Av.	0.141

The Ostwald coefficients were calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The apparatus consisted of an absorption flask connected to a gas buret by a flexible lead capillary. The system was thermostated in a large water bath. The volume of gas absorbed in a known volume of degassed petroleum was measured directly using the gas buret.	(1) Methane. No information. (2) Petroleum. Russian petroleum. Cleaned by boiling in a large copper flask.
	ESTIMATED ERROR: $\delta\alpha/\alpha$ = ± 0.05 (compiler)
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Mineral oil	Rodman, C. J.; Maude, A. H. *Trans. Am. Electrochem. Soc.* 1925, *47*, 71 - 92.
VARIABLES: T/K = 298.15, 353.15 p_1/kPa = 101.3 (760 mmHg)	**PREPARED BY:** H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Bunsen Coefficient α/cm^3(STP)cm^{-3}atm^{-1}	Ostwald Coefficient L/cm^{3}cm^{-3}	Solubility g kg^{-1}
25	298.15	0.381	0.416	0.317
80	353.15	0.164	0.212	0.147

These values appear in the International Critical Tables, McGraw-Hill Book Co., New York and London, Vol. III, pp. 261 - 270 where they are credited to an industrial report edited by A. H. Maude.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus consists of an 180 cm^3 absorption bottle connected to a 100 cm^3 gas buret. The absorption bottle sets in a thermostat, which is attached to a shaking machine.

A weighed sample of oil is introduced into the absorption vessel. The sample is degassed by vacuum taking care to avoid excessive foaming. The gas is brought into the system. An initial buret reading taken, and the shaker is started and reading taken every 5 minutes until 2 or 3 constant readings are obtained.

SOURCE AND PURITY OF MATERIALS:

(1) Methane. No information.

(2) Mineral oil. A Pennsylvania base oil, 96 per cent saturated hydrocarbons, and distilling between 300 and 400°C. Density at 25°C = 0.840 and at 80°C = 0.800 g cm^{-3}. As a commercial product the oil is known as "Wemco A".

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Paraffin Wax	Ridenour, W. P.; Weatherford, W. D.; Capell, R. G. *Ind. Eng. Chem.* 1954, *46*, 2376-81.
VARIABLES: T/K = 345.35 p_1/kPa = 29.00 - 103.48	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Methane Pressure p_1/mmHg	Mol Fraction $10^3 x_1$	Bunsen[a] Coefficient α/	Solubility Coefficient /cm^3 (STP) g^{-1}
72.2	345.35	217.5	1.77	0.305	0.113
		339.5	2.72	0.301	0.174
		479.3	3.88	0.303	0.248
		616.5	5.00	0.303	0.320
		776.2	6.32	0.304	0.404

[a] Bunsen coefficient, α/cm^3 (STP) cm^{-3} atm^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus was similar to the equilibrium adsorption apparatus described by Brunaur, Emmett, and Teller (ref 1) for the measurement of the surface area of a solid catalyst.

A weighed amount of wax was placed in the apparatus. The gas and solvent were equilibrated for 20 to 60 minutes. The gas volume absorbed from the buret system was calculated by the ideal gas law.

The results of the absorption measurement were checked by a desorption measurement. The results of the two measurments agreed well.

SOURCE AND PURITY OF MATERIALS:

(1) Methane. Ohio Chemical Co. 97.8 % methane, 2.2 % heavier hydrocarbons.

(2) Paraffin wax. Described as 122 °F English melting wax. Molecular weight 350, actual melting point 123.2 °F (323.8 K), density 0.7716 g cm^{-3} at 293.3 K and 0.7662 g cm^{-3} at 298.0 K.

ESTIMATED ERROR:

δT/K = ± 2
δp/mmHg = ± 0.2
$\delta \alpha$/cm^3 = ± 0.004 (low pressure) to 0.001 (high press.)

REFERENCES:

1. Brunaur, S.; Emmett, P. H.; Teller, E.
J. Am. Chem. Soc. 1938, *60*, 309.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Gasoline	Pomeroy, R. D.; Lacey, W. N.; Scudder, N. F.; Stapp, F. P. *Ind. Eng. Chem.* 1933, *25*, 1014-1019.
VARIABLES: T/K = 303.15 p_1/MPa = 0.990, 1.982 (9.77, 19.56 atm)	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Pressure		Solubility[1]
t/°C	T/K	p_1/atm	p_1/MPa	c_s/cm^3 cm^{-3}
30	303.15	9.77	0.990	6.00
		19.56	1.982	11.77

[1] Gas volumes measured at 303.15 K (30°C) and 101.325 kPa (1 atm).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:
Measurements were carried out in a brass absorption cell designed for diffusion measurements.

SOURCE AND PURITY OF MATERIALS:
(1) Methane. Gas obtained from a natural gas sample which was treated with activated carbon at pressures up to 70 atm. The methane contained up to 2 per cent ethane and a small amount of nitrogen.

(2) Gasoline. Sample after treatment consisted largely of naphthalenes. B.p.(38 mmHg) t/°C = 79.4 - 88.5, density ρ^{30}/g cm^{-3} = 0.7894.

ESTIMATED ERROR:

δT/K = ± 0.05
$\delta C_s/C_s$ = ± 0.05 (compiler)

COMPONENTS:	ORIGINAL MEASUREMENT:
(1) Methane; CH_4; [74-82-8]	Treshchina, N. I.
(2) Petroleum Mineralized water	*Trudy Vses. Neft. Nauch.-Issled. Geol.-Razvedoch* 1955, No. 83, 566-71. *Chem. Abstr.* 1958, *52*, 6771c.

EXPERIMENTAL VALUES:

Petroleum Sample		Temperature		Solubility Coefficient[a]
Location	Specific Gravity d_4^{20}	t/°C	T/K	
Koschagyl, Emba oilfield	0.917	20	293	0.320
		40	313	0.300
		60	333	0.292
Buguruslan, Volga-Ural oilfield	0.913	20	293	0.334
		40	313	0.315
		60	333	0.308
Koschagyl, Emba oilfield	0.906	20	293	0.345
		40	313	0.300
		60	333	0.296
Kulsary, Emba oilfield	0.886	20	293	0.358
		40	313	0.325
		60	333	0.314
Kulsary, Emba oilfield	0.887	20	293	0.358
		40	313	0.324
		60	333	0.310
Kulsary, Emba oilfield	0.862	20	293	0.405
		40	313	0.350
		60	333	0.316
Grozny Grozny oilfield	0.835	20	293	0.458
		40	313	0.407
		60	333	0.328
Kulsary, Emba oilfield	0.813	20	293	0.502
		40	313	0.463
		60	333	0.428
Kulsary, Emba oilfield	0.782	20	293	0.566
		40	313	0.507
		60	333	0.478
Kerosene	0.819	20	293	0.505
		40	313	0.436
		60	333	0.415
Gasoline	0.746	20	293	0.745
		40	313	0.665
		60	333	0.599

[a] Solubility coefficient appears to be the Bunsen coefficient, $\alpha/cm^3(STP)cm^{-3}atm^{-1}$.

The petroleum viscosities are 47.8, -, 38.0, 11.4, 11.4, 6.5, -, 3.1, - centistoke at 323 K as one comes down the table above.

Some information on the petroleum compositions are given in the paper.

The solubility of methane (natural gas) in water and mineralized water was given. See next page.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Petroleum Mineralized water	Treshchina, N. I. *Trudy Vses. Neft. Nauch.-Issled. Geol.-Razvedoch* 1955, No. 83, 566-71. *Chem. Abstr.* 1958, *52*, 6771c.
VARIABLES: T/K = 293, 313, 333 p_1/kPa = 101.3	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Water Mineral[b] Content m/g dm^{-3}	Solubility Coefficient[a]
20	293	0	0.0331
		10	0.0315
		15	0.0305
		25	0.0290
40	313	0	0.0237
		10	0.0226
		15	0.0224
		25	0.0210
60	333	0	0.0200
		10	0.0190
		15	0.0187
		25	0.0180

[a] Appears to be the Bunsen coefficient.

[b] The solid in the mineralized water does not appear to be identified.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A detailed diagram of the apparatus is given in the paper.	(1) Methane. A natural gas from the western Ukraine, containing 99 % methane and less than 1 % nitrogen. (2) Petroleum, kerosene,and gasoline. Petroleum from wells in three oil fields. Specific gravity, viscosity, and some information on composition and various fractions was given. See data sheet.
	ESTIMATED ERROR: $\delta\alpha/\alpha$ = ± 0.03 (compiler)
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; 74-82-8 (2) Petroleum, crude oils	Safronova, T. P.; Zhuze, T. P. *Khim. i Tekhnol. Topliva i Masel* 1958, *3* (2), 41-46. *Chem. Abstr.* 1958, *52*, 8518d.
VARIABLES: T/K = 293 - 373 p_1/MPa = up to 34.5	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Pressure	Solubility Coefficient
t/°C	T/K	p_1/atm	/cm^3 cm^{-3} atm^{-1}
1. Nebit-Dag (Akchagylian layer) crude oil, Specific gravity, d_4^{20} = 0.8713, kinematic viscosity = 8.70 centistoke.			
100	373	50	0.238
		100	0.265
		200	0.2738
		300	0.2673
2. Romashkino oilfield crude oil, Specific gravity, d_4^{20}= 0.8530, kinematic viscosity = 6.54 centistokes.			
100	373	50	0.322
		100	0.320
		200	0.332
		300	0.337
3. Surakhany oil field crude oil, Specific gravity, d_4^{20}= 0.8494, kinematic viscosity = 5.19 centistokes.			
100	373	50	0.266
		100	0.270
		200	0.281
		300	0.279

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A detailed diagram of the high pressure apparatus was given in the paper.

Many of the data are presented in figures of Solubility/cm^3 cm^{-3} *vs.* p_1/atm. A summary of the graphical data follows:

System	Temperatures t/°C	Maximum Pressure p_1/atm
1	25, 50, 100	340
2	20, 50, 100	300
3	20, 50, 100	300
4	50	300

The fourth system is 4. Tuimazy oil field crude oil, Specific gravity, d_4^{20} = 0.8510, kinematic viscosity = 4.46 centistokes.

SOURCE AND PURITY OF MATERIALS:

(1) Methane. Contained 5.1 % nitrogen, 0.05 % carbon dioxide, and 0.10 % carbon monoxide.

(2) Petroleum crude oils. Four crude oils. Descriptions given above. Additional information on composition in the paper.

ESTIMATED ERROR:

The compiler estimates the data have an uncertainty of 3 to 5 percent.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Kerosene A-1	Hannaert, H.; Haccuria, M.; Mathieu, M. P. *Ind. Chim. Belge* 1967, *32*, 156-164.
VARIABLES: T/K = 233.15 - 293.15	**PREPARED BY:** E. L. Boozer H. L. Clever

EXPERIMENTAL VALUES:

Temperature Interval of Measurements T/K	Methane Mol % Range $10^2 x_1$/mol %	$K\pi\nu$/atm[1] at 293.15 K	Enthalpy of Dissolution ΔH/kcal mol^{-1}	Constant A
233.15-293.15	0.5	187	1.165	3.145

[1] $\log (K\pi\nu/\text{atm}) = A - (\Delta H/\text{cal mol}^{-})/(2.3R(T/\text{K}))$

The author's definitions are:

$K = y_1/x_1 = \dfrac{\text{mole fraction gas in gas phase}}{\text{mole fraction gas in liquid phase}}$,

π /atm = total pressure,

ν = coefficient of fugacity.

The function, $K\pi\nu$/atm, is equivalent to a Henry's constant in the form $H_{1,2}/\text{atm} = (f_1/\text{atm})/x_1$ where f_1 is the fugacity.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The authors describe three methods:

1.A. [Saturat. n° 1]. A measure of the static pressure of saturation in an apparatus which gave a precision of 10 - 15 %.

1.B. [Saturat. n° 2]. A measure of the static pressure of saturation in an apparatus which gave a precision of 2 - 5 %.

2. [Chromato]. A Gas liquid chromatographic method estimated to have a precision of 2 - 5 %.

3. [Anal. directe]. Direct analysis of the gaseous and liquid phases.

Method 1.B. was used for this system.

SOURCE AND PURITY OF MATERIALS:

(1) Methane. Air Liquide. Purity 99.95 per cent.

(2) Kerosene A-1

	Distillation range, °C	Density gcm^{-3},20°C	mol wt
A-1	150-280	0.7805	170

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8]	Svrcek, W.Y.; Mehrotra, A.K.
(2) Athabasca bitumen	*JCPT, J. Can. Pet. Technol.* 1982, *21*, 31-8.

EXPERIMENTAL VALUES:

Temperature		Pressure	Viscosity	Density	Solubility	
t/°C	T/K	p_1/MPa	η/Pa s	ρ/g cm^{-3}	/cm^3 cm^{-3}	wt %
26.2	299.4	9.77	14.1	0.992	18.34	1.320
26.4	299.6	8.25	16.0	1.009	14.96	1.058
26.8	300.0	7.04	19.2	1.002	14.10	1.004
27.5	300.7	5.79	21.2	1.000	11.10	0.793
27.9	301.1	4.46	>23.5	1.011	9.18	0.648
27.5	300.7	3.32	>23.5	1.017	6.41	0.450
28.3	301.5	2.32	>23.5	1.025	4.51	0.314
28.2	301.4	1.59	>23.5	1.016	3.29	0.231
44.8	318.0	2.15	6.15	1.018	2.25	0.158
44.9	318.1	4.28	3.72	0.998	6.79	0.486
45.7	318.9	6.39	2.66	0.997	10.68	0.764
44.6	317.8	8.18	2.05	1.014	13.64	0.961
44.0	317.2	9.63	1.72	0.992	15.47	1.113
43.4	316.6	5.09	3.41	0.994	8.81	0.632
45.8	319.0	3.18	4.46	1.000	5.40	0.386
45.7	318.9	1.08	6.42	1.002	1.53	0.109
69.0	342.2	9.65	0.330	0.983	14.18	1.030
67.9	341.1	8.60	0.400	0.981	12.74	0.928
67.5	340.7	7.47	0.470	0.994	11.66	0.838
67.0	340.2	6.29	0.515	0.990	9.96	0.718
67.2	340.4	5.10	0.610	0.995	7.88	0.565
67.6	340.8	3.64	0.725	1.002	5.21	0.371
67.2	340.4	2.45	0.830	0.993	3.06	0.220
67.5	340.7	0.88	0.990	1.010	1.25	0.088
99.8	373.0	9.44	0.086	0.951	12.73	0.945
100.2	373.4	7.82	0.091	0.957	10.99	0.820
100.2	373.4	5.79	0.106	0.964	9.01	0.667
100.7	373.9	3.82	0.118	0.965	4.28	0.317
99.6	372.8	2.34	0.139	0.966	2.66	0.917
99.4	372.6	0.95	0.158	0.976	0.98	0.072

The volume/volume solubility is cm^3 (STP) cm^{-3}.

The density and viscosity values are for the gas saturated bitumen at the temperature and pressure of the solubility measurement. The density is considered reliable to 0.003 g cm^{-3}.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Athabasca bitumen	Svrcek, W.Y.; Mehrotra, A.K. *JCPT, J. Can. Pet. Technol.* 1982, *21*, 31-8.
VARIABLES: T/K = 299.4 - 373.9 p_1/MPa = 0.88 - 9.77	PREPARED BY: H. L. Clever

EXPERIMENTAL VALUES:

See preceding page.

The solubility data are repeated in a second publication (ref. 2).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The design of the gas-solubility experiment is based on the principle that the gas that is dissolved in bitumen will evolve when the pressure is released and the temperature is slightly increased. The volume of the gas so released was measured at a selected temperature of 100 °C and atm pressure. The volumetric measurements were performed with a mercury-filled Ruska pump. The pressure was monitored with a precision Heise gage. The sample and expansion chamber were contained in a temperature controlled oven. It was assumed that the system was at equilibrium after the viscosity remained constant for at least four hours.

SOURCE AND PURITY OF MATERIALS:

(1) Methane. No information.

(2) Athabasca bitumen. Obtained by toluene extraction of tar-sands of the Athabasca region (ref 1).
Maltene distillables
b.p. 600<°C 42.4%
b.p. 600>°C 36.9%
Asphaltenes 20.7%
Above values not significantly changed by the experiment.

ESTIMATED ERROR:

REFERENCES:

1. Vorndran, L.D.L.; Serres, A.; Donnelly, J.K.; Moore, R.G.; Bennion, D.W. *Can. J. Chem. Eng.* 1980, *58*, 580.
2. Mehrotra, A.K.; Svrcek, W.Y. *JCPT, J. Can. Pet. Technol.* 1982, *21*, 95.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Simulated Light Aromatic Oil	Ramanujam, S.; Leipziger, S.; Weil, S. A. *Ind. Eng. Chem. Process Des. Dev.* 1985, *24*, 107-11.

EXPERIMENTAL VALUES:

T/K	Total Pressure		Equilibrium Liquid-Vapor Mole Fractions							
	p_t/atm	p_t/MPa	Methane		Benzene		Toluene		Decane	
			x_1	y_1	x_2	y_2	x_3	y_3	x_7	y_7
403.3	19.5	1.98	0.035	0.873	0.410	0.092	0.210	0.024	0.119	0.003
	31.0	3.14	0.056	0.907	0.424	0.068	0.201	0.015	0.113	0.003
	51.0	5.17	0.086	0.935	0.431	0.049	0.193	0.011	0.104	0.002
	61.6	6.24	0.104	0.931	0.435	0.051	0.188	0.011	0.099	0.0018
	69.5	7.04	0.118	0.950	0.426	0.038	0.187	0.009	0.099	0.001
	82.7	8.38	0.148	0.957	0.403	0.033	0.183	0.007	0.095	0.001
	106.5	10.79	0.186	0.964	0.377	0.028	0.179	0.005	0.096	0.001
450.0	22.2	2.25	0.031	0.702	0.409	0.209	0.212	0.058	0.128	0.0096
	33.1	3.35	0.046	0.772	0.425	0.160	0.201	0.045	0.118	0.007
	45.6	4.62	0.070	0.817	0.426	0.131	0.195	0.033	0.112	0.007
	53.7	5.44	0.083	0.843	0.427	0.112	0.188	0.028	0.108	0.006
	61.9	6.27	0.101	0.872	0.419	0.091	0.189	0.022	0.105	0.005
	82.0	8.31	0.135	0.898	0.400	0.072	0.182	0.017	0.103	0.004
	96.5	9.78	0.160	0.905	0.389	0.067	0.179	0.016	0.101	0.004
494.4	23.5	2.38	0.023	0.517	0.400	0.304	0.179	0.096	0.133	0.029
	35.9	3.64	0.042	0.593	0.411	0.258	0.187	0.082	0.119	0.022
	40.1	4.06	0.054	0.631	0.411	0.233	0.185	0.075	0.116	0.021
	56.9	5.77	0.082	0.706	0.403	0.195	0.183	0.054	0.109	0.015
	64.5	6.55	0.098	0.725	0.404	0.183	0.182	0.050	0.107	0.014
	74.0	7.50	0.115	0.749	0.389	0.162	0.177	0.044	0.106	0.017
	100.1	10.14	0.151	0.760	0.378	0.159	0.171	0.042	0.102	0.014
550.0	33.1	3.35	0.038	0.368	0.311	0.336	0.159	0.125	0.138	0.065
	40.1	4.06	0.050	0.418	0.319	0.313	0.159	0.112	0.139	0.058
	51.4	5.21	0.074	0.475	0.330	0.274	0.166	0.103	0.130	0.052
	73.8	7.48	0.104	0.570	0.333	0.232	0.165	0.085	0.114	0.039
	89.8	9.10	0.134	0.587	0.337	0.223	0.166	0.081	0.108	0.041
	97.6	9.89	0.143	0.595	0.346	0.228	0.162	0.078	0.103	0.039

Mole fraction in liquid x.

Mole fraction in vapor y.

The simulated light aromatic oil has 16 components. Only the compositions with respect to benzene, toluene and decane are given above. The three liquids made up 0.901 mole fraction of the oil. The liquid-vapor composition of all 16 components in given in the origianl paper.

See the next page for the mass fraction and mole fraction composition of the oil.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Simulated Light Aromatic Oil	Ramanujam, S.; Leipziger, S.; Weil, S. A. *Ind. Eng. Chem. Process Des. Dev.* 1985, *24*, 107-11.
VARIABLES: T/K = 403.0 - 550.0 p_t/MPa = 1.98 - 10.79	PREPARED BY: H. L. Clever

SOURCE AND PURITY OF MATERIALS:

(1) Methane. Matheson Gas Co. Stated to be 99.9 percent purity.

(2) Simulated Light Aromatic Oil. Composition:

No.	Component	Formula	Registry Number	Mass Fraction	Mole Fraction
1.	Benzene	C_6H_6	[71-43-2]	0.458	0.548
2.	Toluene or methylbenzene	C_7H_8	[108-88-3]	0.183	0.186
3.	Octane	C_8H_{18}	[111-65-9]	0.0037	0.003
4.	*p*-Xylene or 1,4-dimethyl benzene	C_8H_{10}	[106-42-3]	0.092	0.081
5.	*o*-Xylene or 1,2-dimethyl benzene	C_8H_{10}	[95-47-6]	0.027	0.024
6.	Mesitylene or 1,3,5-trimethyl benzene	C_9H_{12}	[108-67-8]	0.011	0.009
7.	Decane	$C_{10}H_{22}$	[124-18-5]	0.131	0.086
8.	Naphthalene	$C_{10}H_8$	[91-20-3]	0.055	0.040
9.	1-Methylnaphthalene	$C_{11}H_{10}$	[90-12-0]	0.014	0.009
10.	1,1'-Biphenyl	$C_{12}H_{10}$	[92-52-4]	0.0055	0.0034
11.	Acenaphthene or 1,2-Dihydro-naphthylene	$C_{12}H_{10}$	[83-32-9]	0.0046	0.0027
12.	Fluorene or 9-*H*-fluorene	$C_{13}H_{10}$	[86-73-7]	0.0046	0.0026
13.	1-Phenylnaphthalene	$C_{16}H_{12}$	[605-02-7]	0.0055	0.0025
14.	Phenanthrene	$C_{14}H_{10}$	[85-01-8]	0.0046	0.0024
15.	Fluoranthene	$C_{16}H_{10}$	[206-44-0]	0.0018	0.0008
16.	Chrysene	$C_{18}H_{12}$	[218-32-9]	0.0014	0.0006

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The apparatus is a modification of that of Simnick *et al.* (ref 1). The details are given by Srinivasan (ref 2).

The apparatus is a recirculation type equilbration system. The equilibration cell is a 300 cm^3 autoclave. The liquid was recycled by a metering pump.

Each phase was sampled in its respective sampling loop. The samples were analyzed by GLC with a programmable integrator.

All chemicals were used as received. No decomposition of the components, or reaction of the components was observed in the study.

Values are the average of two determinations. Agreement for the major components range from 1 to 5 %.

SOURCE AND PURITY OF MATERIALS:

(2) Simulated oil (continued)
Fisher Scientific Co. Benzene (crystallizable, low thiophene), Toluene (99 %), Octane (Reagent), *p*-Xylene (certified), *o*-Xylene (Reagent), naphthalene (scintanalyzed), 1-methylnaphthalene (purified), Biphenyl (Reagent).
Phillips Petroleum Co. Decane (99 %).
Aldrich Chemical Co. Numbers 11 - 16 on list above.

ESTIMATED ERROR:

δT/K = ± 0.5
$\delta p_1/p_1$ = ± 0.0025

REFERENCES:

1. Simnick, J. J.; Lawson, C. C. Lin, H. M.; Chao, K. C. *A. I. Ch. E. J.* 1877, *23*, 469.
2. Srinivasan, R. Ph. D. Thesis, Department Gas Engineering, IIT, Chicago, IL 1981.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8]	Fischer, F.; Zerbe, C.
(2) Various pure solvents and petroleum products (see table below)	*Brennstoff-Chem.* 1923, *4*, 17-9.

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Pressure p_1/atm	Solvent /g	Gas Volume Evolved /cm³	Gas in 1 g of Solvent at 1 atm /cm³
Water; H_2O; [7732-18-5]					
20	293	18	71.9	112	0.09
Benzene; C_6H_6; [71-43-2]					
23	296	17.5	10.8	97	0.51
Benzene, technical; C_6H_6; [71-43-2]					
23	296	17.5	11.5	94	0.47
Dimethylbenzene; C_8H_{10}; [1330-20-7]					
23	296	18	10.6	102	0.53
Methanol; CH_4O; [67-56-1]					
20	293	17	13.3	104	0.46
Ethanol; C_2H_6O; [64-17-5]					
21	294	17.5	9.3	98	0.60
3-Methyl-1-butanol or isoamyl alcohol; $C_5H_{12}O$; [123-51-3]					
20	293	17	11.3	84	0.44
Methylphenol or tricresol; C_7H_8O; [1319-77-3]					
21	294	17	20.5	92	0.26
1,1'-Oxybisethane or diethylether; $C_4H_{10}O$; [60-29-7]					
20	293	18	2.7	44	0.91
2-Propanone or acetone; C_2H_6O; [67-64-1]					
20	293	18	7.8	81	0.61
Acetic acid; $C_2H_4O_2$; [64-19-7]					
20	293	18	8.7	71	0.45
Trichloromethane; or chloroform; $CHCl_3$; [67-66-3]					
20	293	18	15.0	88	0.82
Carbon disulfide; CS_2; [75-15-0]					
20	293	18	9.9	64	0.36
Aniline; C_6H_7N; [62-53-3]					
20	293	18	33.6	90	0.16
Nitrobenzene; $C_6H_5NO_2$; [98-95-3]					
20	293	18	32.0	88	0.16
Petroleum					
20	293	14	12.0	94	0.56
20	293	15	12.3	101	0.55
Paraffin oil					
20	293	15	10.4	68	0.44

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Methane; CH_4; [74-82-8] (2) Various pure solvents and petroleum products (see table below)	Fischer, F.; Zerbe, C. *Brennstoff-Chem.* 1923, *4*, 17-9.
VARIABLES: T/K = 293, 294, 295 p_1/kPa = 1419 - 1824 Gas volumes and solubilities 101.3 kPa	**PREPARED BY:** H. L. Clever

EXPERIMENTAL VALUES:

Temperature t/°C	Temperature T/K	Pressure p_1/atm	Solvent w/g	Gas Volume Evolved v/cm³	Gas in 1 g of Solvent at 1 atm /cm³
Petroleum ether, boiling point up to 65 °C					
22	295	17	2.6	62	1.34
Petroleum ether, boiling point 65 - 100 °C					
20	293	18	5.9	89	0.84
Petroleum ether, boiling point 100 - 150 °C					
20	293	18	8.6	102	0.66
Urteerkohlenwasserstoffe (low temperature tar hydrocarbons)					
20	293	18	12.3	89	0.40
Urteerphenole (low temperature tar phenols), 250 - 300 °C					
20	293	18	14.6	71	0.27
Urteerfraktion (low temperature tar fraction), 250-300 °C					
21	294	17	15.3	94	0.36
Braunkohlentreiböl (lignite coal motor oil)					
21	294	18	13.1	92	0.39
Braunkohlenkreosot (lignite coal creosote)					
21	294	17	24.8	94	0.22
Steinkohlenkarbolöl (coal tar oil)					
22	295	18	15.5	89	0.32

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The gas was pumped into an evacuated steel cylinder which contained the degassed solvent. The cylinder was shaken until a constant pressure indicated equilibrium was attained. Part of the saturated liquid was transferred into a buret where the dissolved gas was extracted at one atm pressure. The saturation pressure was taken as the mean of the cylinder pressure before and after sampling. The change in pressure before and after sampling was two atm. See the earlier paper on oxygen solubility (ref 1) for more information.

EVALUATORS'S COMMENT: These data are of marginal accuracy. They should be used only if more modern values are not available for a system.

Gas volumes measured at atmospheric pressure and the temperature of the measurement.

SOURCE AND PURITY OF MATERIALS:

(1) Methane. Gas sample contained 79.4 % methane, 17.1 % nitrogen, 2.8 % oxygen, and 0.7 % carbon dioxide.

(2) Solvents. Sources not given. Density and sometimes vapor pressure on pure compounds. Boiling points of the petroleum ethers. Data are in (ref 1).

ESTIMATED ERROR:

10 - 25 per cent (compiler).

REFERENCES:

1. Fischer, F.; Pfleiderer, G. *Z. Anorg. Chem.* 1922, *124*, 61.