

COMPONENTS:

1. Methane; CH₄; [74-82-8]
2. Octane; C₈H₁₈; [111-65-9]
or
Nonane; C₉H₂₀; [111-84-2]

EVALUATOR:

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March 1984.

EVALUATION:

Methane + Octane

There are only two sets of data on this system at elevated pressure and there are fairly large discrepancies between the two sets. The data of Frolich *et al.* (1) are thought to be less reliable and were originally presented in graphical form. These data are classified as doubtful. The data of Kohn and Bradish (2) are more extensive and are believed to be more reliable and hence are classified as tentative.

Methane + Nonane

Shipman and Kohn (3) have studied this system at eight temperatures between 223 K and 423 K and their data are classified as tentative. The only other study on this system appears to be that of Savvina *et al.* (4). These workers present data at temperatures between 313 K and 423 K but only in graphical form on a scale which lacks sufficient accuracy to be considered here.

References

1. Frolich, P. K.; Tauch, E. J.; Hogan, J. J.; Peer, A. A.
Ind. Eng. Chem., 1931, *23*, 548.
2. Kohn, J. P.; Bradish, W. F.
J. Chem. Eng. Data, 1964, *9*, 5.
3. Shipman, L. M.; Kohn, J. P.
J. Chem. Eng. Data, 1966, *11*, 176.
4. Savvina, Ya. D.; Velikovskii, A. S.
J. Phys. Chem. (USSR), 1956, *30*, 1597.

COMPONENTS: 1. Methane; CH ₄ ; [74-82-8] 2. Octane; C ₈ H ₁₈ ; [111-65-9]		ORIGINAL MEASUREMENTS: Frolich, P.K.; Tauch, E.J.; Hogan, J.J.; Peer, A.A. <i>Ind. Eng. Chem.</i> <u>1931</u> , 23, 548-550	
VARIABLES: Pressure		PREPARED BY: C.L. Young	
EXPERIMENTAL VALUES:			
T/K	P/MPa	Solubility*	Mole fraction of methane in liquid, ⁺ <i>x</i> _{CH₂}
298.15	1.0	11	0.068
	2.0	23	0.133
	3.0	36	0.194
	4.0	50	0.251
	5.0	64	0.300
	6.0	79	0.346
	7.0	94	0.386
	8.0	109	0.422
	9.0	123	0.451
		10.0	138
* Data taken from graph in original article. Volume of gas measured at 101.325 kPa and 298.15 K dissolved by unit volume of liquid measured under the same conditions.			
+ Calculated by compiler.			
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: Stated that the materials were the highest purity available. Purity 98 to 99 mole per cent.	
		ESTIMATED ERROR: $\delta T/K = \pm 0.1$; $\delta x_{CH_4} = \pm 5\%$	
		REFERENCES:	

COMPONENTS:		ORIGINAL MEASUREMENTS:	
1. Methane; CH ₄ ; [74-82-8] 2. Octane; C ₈ H ₁₈ ; [111-65-9]		Kohn, J. P.; Bradish, W. F. <i>J. Chem. Engng. Data</i> <u>1964</u> , 9, 5-8.	
VARIABLES:		PREPARED BY:	
Temperature, pressure		C. L. Young	
EXPERIMENTAL VALUES:			
T/K	P/MPa	Mole fraction of methane in liquid, x_{CH_4}	in vapor, y_{CH_4}
223.15	1.01	0.086	-
	2.03	0.168	-
	3.04	0.244	-
	4.05	0.312	-
	5.07	0.370	-
	6.08	0.424	-
	7.09	0.472	-
248.15	1.01	0.065	-
	2.03	0.128	-
	3.04	0.187	-
	4.05	0.238	-
	5.07	0.288	-
	6.08	0.337	-
	7.09	0.373	-
273.15	1.01	0.054	-
	2.03	0.106	-
	3.04	0.155	-
	4.05	0.201	-
	5.07	0.244	-
	6.08	0.285	-
	7.09	0.319	-
298.15	1.01	0.047	0.998
	2.03	0.094	0.999 (cont.)
AUXILIARY INFORMATION			
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:	
Borosilicate glass equilibrium cell. Temperature measured with platinum resistance thermometer, pressure measured on Bourdon gauge. Samples of methane added to octane. Dew and bubble point pressure measured. Data presented in original as smoothed values (as function of pressure in atm). Details of method in source and ref. 1.		1. Phillips Petroleum Co. sample fractionated, purity > 99.5 mole per cent. 2. Phillips Petroleum Co. sample, "pure" grade, purity at least 99 mole per cent.	
		ESTIMATED ERROR: $\delta T/K = \pm 0.07$; $\delta P/\text{MPa} = \pm 0.01$; $\delta x_{\text{CH}_4}, \delta y_{\text{CH}_4} = \pm 0.0015$.	
		REFERENCES: 1. Kohn, J. P.; Kurata, F. <i>Petrol. Process.</i> <u>1956</u> , 11, 57.	

COMPONENTS:		ORIGINAL MEASUREMENTS:		
1. Methane; CH ₄ ; [74-82-8]		Kohn, J. P.; Bradish, W. F.		
2. Octane; C ₈ H ₁₈ ; [111-65-9]		<i>J. Chem. Engng. Data</i>		
		<u>1964</u> , 9, 5-8.		
EXPERIMENTAL VALUES:				
T/K	P/MPa	Mole fraction of methane		
		in liquid, x_{CH_4}	in vapor, y_{CH_4}	
298.15	3.04	0.136	0.999	
	4.05	0.178	0.999	
	5.07	0.220	0.999	
	6.08	0.255	0.999	
323.15	7.09	0.287	0.999	
	1.01	0.043	0.991	
	2.03	0.083	0.995	
	3.04	0.122	0.996	
	4.05	0.161	0.997	
348.15	5.07	0.188	0.997	
	6.08	0.234	0.997	
	7.09	0.265	0.997	
	1.01	0.038	-	
	2.03	0.075	0.985	
	3.04	0.112	0.990	
	4.05	0.148	0.992	
373.15	5.07	0.183	0.993	
	6.08	0.218	0.994	
	7.09	0.251	0.994	
	1.01	0.033	0.947	
	2.03	0.069	0.971	
	3.04	0.104	0.979	
423.15	4.05	0.139	0.982	
	5.07	0.173	0.984	
	6.08	0.207	0.985	
	7.09	0.240	0.986	
	1.01	0.028	-	
	2.03	0.063	0.881	
	3.04	0.097	0.914	
	4.05	0.131	0.930	
	5.07	0.164	0.939	
	6.08	0.196	0.945	
	7.09	0.229	0.949	

EXPERIMENTAL VALUES:				
T/K (t/ C)	P/kgcm ⁻³	P/Mpa	methane	K-value 2,2,3-trimethyl- pentane
313.2 (40)	20	1.96	10.30	0.080
	40	3.92	5.87	0.045
	60	5.88	4.14	0.039
	100	9.81	2.70	0.045
	150	14.7	1.95	0.063
	180	17.7	1.69	0.101
	200	19.6	1.52	0.516
	210	20.6	1.41	0.218
	220	21.6	1.25	0.400
	225	22.1	1.10	0.685
	333.2 (60)	40	3.92	6.02
60		5.88	4.25	0.052
100		9.81	2.74	0.058
150		14.7	1.99	0.089
180		17.7	1.70	0.123
200		19.6	1.51	0.188
210		20.6	1.37	0.272
220		21.6	1.18	0.516
224		22.0	1.01	0.935
353.2 (80)		20	1.96	11.56
	40	3.92	6.26	0.070
	60	5.88	4.42	0.065
	100	9.81	2.83	0.075
	150	14.7	2.03	0.105
	180	17.7	1.80	0.142
	200	19.6	1.48	0.229

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:

Values appear to be determined using apparatus described in ref.(1).

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

REFERENCES:

1. Savvina, Ya. D.; Velikovskii, A. S. *Tr. Vses. Nauchno-Issled. Inst. Prirodn. Gazov.*, 1962, 17/25, 163.

COMPONENTS:		ORIGINAL MEASUREMENTS:		
1. Methane; CH ₄ ; [74-82-8] 2. 2,2,3-Trimethylpentane; C ₈ H ₁₈ ; [564-02-3]		Savvina, Ya. D. <i>Tr. Vses. Nauchno-Issled. Inst. Prirodn. Gazov.</i> <u>1962</u> , 17/25, 185-196.		
EXPERIMENTAL VALUES:				
T/K (t/ C)	P/kgcm ⁻³	P/Mpa	methane	K-value 2,2,3-trimethyl- pentane
353.2 (80)	210 220	20.6 21.6	1.34 1.10	0.309 0.680
373.2 (100)	20 40 60 100 150 180 200 210 216	1.96 3.92 5.88 9.81 14.7 17.7 19.6 20.6 21.2	12.23 6.62 4.48 2.86 2.05 1.69 1.43 1.25 1.05	0.180 0.091 0.080 0.093 0.128 0.184 0.278 0.429 0.827
393.2 (120)	40 60 100 150 180 200 210	3.92 5.88 9.81 14.7 17.7 19.6 20.6	6.71 4.52 2.92 2.04 1.66 1.35 1.05	0.131 0.102 0.113 0.143 0.214 0.370 0.823
423.2 (140)	20 40 60 100 150 180 190 195	1.96 3.92 5.88 9.81 14.7 17.7 18.6 19.1	12.53 6.81 4.60 2.91 2.99 1.49 1.27 1.06	0.316 0.246 0.134 0.139 0.182 0.327 0.516 0.826

COMPONENTS:			ORIGINAL MEASUREMENTS:	
1. Methane; CH ₄ ; [74-82-8] 2. Nonane; C ₉ H ₂₀ ; [111-84-2]			Shipman, L.M.; Kohn, J.P. J. Chem. Engng. Data. <u>1966</u> , 11, 176-180.	
VARIABLES:			PREPARED BY:	
Temperature, pressure			C.L. Young	
EXPERIMENTAL VALUES:				
T/K	P/atm	P/MPa	Mole fraction of methane in liquid, x_{CH_4}	Mole fraction of methane in gas, y_{CH_4}
218.47	5.00	0.51	0.046	
217.43	10.00	1.01	0.093	
215.56	20.00	2.03	0.181	
213.86	30.0	3.04	0.263	
212.35	40.0	4.05	0.343	
209.85	60.0	6.08	0.470	
208.35	100.0	10.13	0.570	
223.15	10.00	1.013	0.0989	0.9999
	20.00	2.027	0.1737	0.9999
	30.00	3.040	0.2418	0.9999
	40.00	4.053	0.3033	0.9999
	50.00	5.066	0.3582	0.9999
	60.00	6.080	0.4065	0.9999
	70.00	7.093	0.4482	0.9999
	80.00	8.106	0.4883	0.9999
	90.00	9.119	0.5118	0.9999
	100.00	10.133	0.5336	0.9999
248.15	10.00	1.013	0.0678	0.9999
	20.00	2.027	0.1288	0.9999
	30.00	3.040	0.1856	0.9999
	40.00	4.053	0.2381	0.9999
	50.00	5.066	0.2863	0.9999
	60.00	6.080	0.3302	0.9999
	70.00	7.093	0.3698	0.9999
	80.00	8.106	0.4051	0.9999
	90.00	9.119	0.4361	0.9999
AUXILIARY INFORMATION				
METHOD/APPARATUS/PROCEDURE:			SOURCE AND PURITY OF MATERIALS:	
Borosilicate static equilibrium cell. Temperature measured with platinum resistance thermometer. Pressure measured with Bourdon gauge. Methane added to nonane and equilibrated. Temperature-pressure diagram constructed from bubble and dew points of mixtures of known composition. Smoothed data, as given above, reported in source. Details of apparatus in source and ref. (1) and (2).			1. Phillips Petroleum Co. sample, purified as in ref. (1). Final purity better than 99.5 mole per cent.	
			2. Phillips Petroleum Co. sample, purity better than 99 mole per cent.	
			ESTIMATED ERROR:	
			$\delta T/K = \pm 0.1$; $\delta P/\text{MPa} = \pm 0.007$; δx_{CH_4} ; $\delta y_{\text{CH}_4} = \pm 0.003$.	
			REFERENCES:	
			1. Kohn, J.P.; <i>Am. Inst. Chem. Engrs. J.</i> <u>1961</u> , 7, 514.	
			2. Kohn, J.P.; Kurata, F. <i>Petrol. Process.</i> <u>1956</u> , 11, 57.	

COMPONENTS:		ORIGINAL MEASUREMENTS:		
1. Methane; CH ₄ ; [74-82-8]		Shipman, L.M.; Kohn, J.P.		
2. Nonane; C ₉ H ₂₀ ; ; [111-84-2]		J. Chem. Eng. Data. <u>1966</u> , 11, 176-180.		
EXPERIMENTAL VALUES:				
T/K	P/atm	P/MPa	Mole fraction of methane in liquid, x_{CH_4}	Mole fraction of methane in gas, y_{CH_4}
248.15	100.00	10.133	0.4629	0.9999
273.15	10.00	1.013	0.0540	0.9999
	20.00	2.027	0.1069	0.9999
	30.00	3.040	0.1563	0.9999
	40.00	4.053	0.2023	0.9999
	50.00	5.066	0.2448	0.9999
	60.00	6.080	0.2838	0.9999
	70.00	7.093	0.3194	0.9999
	80.00	8.106	0.3515	0.9999
	90.00	9.119	0.3801	0.9999
	100.00	10.133	0.4087	0.9999
	120.00	12.159	0.4639	0.9999
	140.00	14.186	0.5131	0.9999
	160.00	16.212	0.5538	0.9999
	180.00	18.239	0.5922	0.9999
	200.00	20.265	0.6234	0.9999
	220.00	22.292	0.6512	0.9990
	240.00	24.318	0.6781	0.9980
	260.00	26.345	0.7075	0.9931
	280.00	28.371	0.7434	0.9788
	300.00	30.398	0.7908	0.9572
310.00	31.411	0.8200	0.9410	
315.00	31.917	0.8450	0.9250	
318.00	32.221	0.8850	0.8850	
298.15	10.00	1.013	0.0509	0.9999
	20.00	2.027	0.0986	0.9999
	30.00	3.040	0.1426	0.9999
	40.00	4.053	0.1832	0.9999
	50.00	5.066	0.2205	0.9999
	60.00	6.080	0.2550	0.9999
	70.00	7.093	0.2870	0.9999
	80.00	8.106	0.3166	0.9999
	90.00	9.119	0.3442	0.9999
	100.00	10.133	0.3664	0.9999
	120.00	12.159	0.4160	0.9999
	140.00	14.186	0.4637	0.9999
	160.00	16.212	0.5094	0.9999
	180.00	18.239	0.5533	0.9929
	200.00	20.265	0.5952	0.9883
	220.00	22.292	0.6352	0.9867
	240.00	24.318	0.6733	0.9851
	260.00	26.345	0.7094	0.9803
	280.00	28.371	0.7437	0.9695
	300.00	30.398	0.7760	0.9495
310.00	31.411	0.8090	0.9351	
315.00	31.917	0.8230	0.9200	
319.00	32.323	0.8800	0.8800	
323.15	10.00	1.013	0.0449	0.9999
	20.00	2.027	0.0860	0.9999
	30.00	3.040	0.1251	0.9999
	40.00	4.054	0.1622	0.9999
	50.00	5.066	0.1974	0.9999
	60.00	6.080	0.2306	0.9999
	70.00	7.093	0.2618	0.9999
	80.00	8.106	0.2911	0.9999
	90.00	9.119	0.3184	0.9999
	100.00	10.133	0.3471	0.9999
	120.00	12.159	0.3994	0.9999
	140.00	14.186	0.4480	0.9999
	160.00	16.212	0.4935	0.9970
	180.00	18.239	0.5365	0.9906
	200.00	20.265	0.5775	0.9870
	220.00	22.292	0.6173	0.9857

COMPONENTS:		ORIGINAL MEASUREMENTS:		
1. Methane; CH ₄ ; [74-82-8]		Shipman, L.M.; Kohn, J.P.		
2. Nonane; C ₉ H ₂₀ ; [111-84-2]		J. Chem. Eng. Data. <u>1966</u> , 11, 176-180.		
T/K	P/atm	P/MPa	Mole fraction of methane in liquid, x_{CH_4}	in gas, y_{CH_4}
323.15	240.00	24.318	0.6562	0.9837
	260.00	26.345	0.6950	0.9783
	280.00	28.371	0.7343	0.9662
	300.00	30.398	0.7745	0.9445
	310.00	31.411	0.8003	0.9292
	315.00	31.917	0.8230	0.9120
	318.00	32.221	0.8720	0.8720
348.15	10.00	1.013	0.0448	0.9999
	20.00	2.027	0.0826	0.9999
	30.00	3.040	0.1187	0.9999
	40.00	4.053	0.1532	0.9999
	50.00	5.066	0.1861	0.9999
	60.00	6.080	0.2174	0.9999
	70.00	7.093	0.2470	0.9999
	80.00	8.106	0.2750	0.9999
	90.00	9.119	0.3014	0.9999
	100.00	10.133	0.3271	0.9999
	120.00	12.159	0.3775	0.9999
	140.00	14.186	0.4257	0.9999
	160.00	16.212	0.4720	0.9960
	180.00	18.239	0.5168	0.9870
	200.00	20.265	0.5605	0.9830
	220.00	22.292	0.6035	0.9800
	240.00	24.318	0.6463	0.9752
	260.00	26.345	0.6891	0.9662
	280.00	28.371	0.7324	0.9502
	300.00	30.398	0.7765	0.9270
310.00	31.411	0.8195	0.8940	
313.00	31.715	0.8600	0.8600	
373.15	10.00	1.013	0.0362	0.9740
	20.00	2.027	0.0715	0.9824
	30.00	3.040	0.1058	0.9878
	40.00	4.053	0.1392	0.9908
	50.00	5.066	0.1716	0.9921
	60.00	6.080	0.2030	0.9921
	70.00	7.093	0.2335	0.9915
	80.00	8.106	0.2630	0.9909
	90.00	9.119	0.2915	0.9909
	100.00	10.133	0.3190	0.9921
423.15	10.00	1.013	0.0329	0.9207
	20.00	2.027	0.0702	0.9360
	30.00	3.040	0.1060	0.9485
	40.00	4.053	0.1402	0.9584
	50.00	5.066	0.1727	0.9656
	60.00	6.080	0.2037	0.9701
	70.00	7.093	0.2330	0.9719
	80.00	8.106	0.2608	0.9710
	90.00	9.119	0.2870	0.9674
	100.00	10.133	0.3115	0.9611

EXPERIMENTAL VALUES:		P/kgcm ⁻³	P/Mpa	K-value		
T/K (t/°C)				methane	nonane	
313.2 (40)		10	0.98	17.43	0.006	
		20	1.96	9.69	0.002	
		40	3.92	5.42	0.002	
		60	5.88	3.82	0.003	
		100	9.81	2.61	0.005	
		150	14.7	2.00	0.009	
		200	19.6	1.66	0.017	
		250	24.5	1.42	0.029	
		280	27.5	1.31	0.063	
		300	29.4	1.25	0.099	
		320	31.4	1.17	0.211	
		329	32.3	1.06	0.579	
	333.2 (60)		10	0.98	19.03	0.010
			20	1.96	10.35	0.005
		40	3.92	5.65	0.004	
		60	5.88	4.02	0.005	
		100	9.81	2.73	0.007	
		150	14.7	2.06	0.013	
		200	19.6	1.69	0.024	
		250	24.5	1.44	0.044	
		280	27.5	1.33	0.079	
		300	29.4	1.26	0.129	
		320	31.4	1.18	0.208	
		326	32.0	1.08	0.535	

AUXILIARY INFORMATION	
METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Values appear to be determined using apparatus described in ref. (1).	No details given.
	ESTIMATED ERROR:
	REFERENCES:
	1. Savvina, Ya. D.; Velikovskii, A. S. Tr. Vses. Nauchno-Issled. Inst. Prirodn. Gazov., 1962, 17/25, 163.

COMPONENTS:		ORIGINAL MEASUREMENTS:			
1. Methane; CH ₄ ; [74-82-8]		Savvina, Ya. D.			
2. Nonane; C ₉ H ₂₀ ; [111-84-2]		Tr. Vses. Nauchno-Issled. Inst. Prirodn. Gazov., 1962, 17/25, 185-196.			
T/K (t/°C)	P/kgcm ⁻³	P/Mpa	methane	K-value nonane	
353.2 (80)	20	1.96	10.91	0.007	
	40	3.92	5.91	0.006	
	60	5.88	4.18	0.007	
	100	9.81	2.83	0.009	
	150	14.7	2.11	0.015	
	200	19.6	2.71	0.029	
	250	24.5	1.45	0.067	
	280	27.5	1.33	0.109	
	300	29.4	1.27	0.163	
	322	31.6	1.09	0.535	
	373.2 (100)	20	1.96	11.78	0.011
		40	3.92	6.26	0.010
60		5.88	4.39	0.010	
100		9.81	2.93	0.013	
150		14.7	2.16	0.020	
200		19.6	1.74	0.038	
250		24.5	1.48	0.076	
280		27.5	1.32	0.135	
300		29.4	1.21	0.244	
310		30.4	1.14	0.385	
313		30.7	1.11	0.485	
393.2 (120)		20	1.96	12.31	0.016
	40	3.92	6.54	0.014	
	60	5.88	4.59	0.015	
	100	9.81	3.03	0.018	
	150	14.7	2.15	0.026	
	200	19.6	1.72	0.051	
	250	24.5	1.46	0.092	
	270	26.5	1.33	0.232	
	280	27.5	1.27	0.232	
	290	28.4	1.20	0.333	
	297	29.1	1.10	0.563	
	423.2 (150)	20	1.96	12.49	0.029
40		3.92	6.89	0.026	
60		5.88	4.73	0.027	
100		9.81	2.92	0.030	
150		14.7	2.09	0.039	
200		19.6	1.67	0.080	
250		24.5	1.38	0.167	
270		26.5	1.28	0.339	
278		27.3	1.08	0.681	