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Orthobaric densities and molar volumes of liquids

Part 2B Alkadienes and alkynes

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ORTHOBARIC DENSITIES AND MOLAR VOLUMES OF LIQUIDS
PART 2B: ALKADIENES AND ALKYNES

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ORTHOBARIC DENSITIES AND MOLAR VOLUMES OF LIQUIDS
PART 2B: ALKADIENES AND ALKYNES

1. INTRODUCTION

This Data Item presents orthobaric liquid densities and molar volumes of the alkadienes and alkynes listed in Table 1 (pages 2 and 3), with alternative names, if any.

The values of density and molar volume given in the Tables have been obtained by evaluating, for each compound, an equation of the form

$$\ln(d/d_c) = -\ln(V_m/V_{mc}) = a_1q + a_2q^2 + a_3q^3 + a_4q^4. \quad (1)$$

Equation (1) was fitted to the selected experimental data for buta-1,3-diene and propyne as described in Appendix A. For each of the remaining compounds the equation depends on only three or fewer values of density at ambient, or lower, temperatures and the estimated value of the critical density. Table 2 gives the critical temperature, critical density and the coefficients a_1 , a_2 , a_3 and a_4 for each compound to be used in Equation (1).

Tables 3(D) to 13(D) present values of density in kg/m^3 from the freezing point, T_f , to the critical point at intervals of 10°C . Tables 3(V) to 13(V) present molar volumes in cm^3/mol over the same temperature range at intervals of 10 K.

Values of density and molar volume in the Tables with two decimal places are considered to have an uncertainty between 0.01 and 0.1 per cent. Values with one decimal place are considered to have an uncertainty between 0.1 and 1.0 per cent and values with no decimal places an uncertainty between 1 and 10 per cent.

The sources of experimental data for each compound and the calculation procedure are detailed in Appendix A which also contains a summary of the critical constants of all the compounds.

The value of the gas constant and atomic weights were obtained from References 1 and 2.

2. NOTATION

a_1, a_2, a_3, a_4	non-dimensional constants for each compound in Equation (1)	
d	density	kg/m^3
p	saturation pressure	MPa
q	$(1-T_r)^{1/3}$	
M	relative molar mass (molecular weight)	
R	gas constant, $8.314\ 510\ \text{J}/(\text{mol K})$	
T	temperature on the International Practical Temperature Scale 1968, IPTS 68, $(273.15 + ^\circ\text{C})$	K
t	Celsius temperature	$^\circ\text{C}$
V_m	molar volume	cm^3/mol
Z	compression factor, pV/RT	
suffices		
c	denotes value at critical point	
f	denotes value at freezing point	
r	denotes reduced quantity, e.g. $T_r = T/T_c$	

3. REFERENCES

1. CODATA Recommended Values of Physical Constants, Bulletin No.63, 1986.
2. IUPAC Molar Masses of the Elements, Pure Appl.Chem., Vol.58, pp.1677-1692, 1986.

TABLE 1
LIST of COMPOUNDS

The Empirical Formula, Name, Alternative Name, if any, and location of the Tables giving the Orthobaric Liquid Density, d , and the Orthobaric Liquid Molar Volume, V_m , for each compound considered in this Data Item are as follows.

No.	Emp. Form.	Name	Alternative Names	Table Pages d V_m
C₃ ALKADIENES				
1	C ₃ H ₄	Propadiene	Allene	6 17
C₄ ALKADIENES				
2	C ₄ H ₆	Buta-1,2-diene	1,2-Butadiene	6 17
3		Buta-1,3-diene	1,3-Butadiene	6 17
C₅ ALKADIENES				
4	C ₅ H ₈	Penta-1,2-diene	1,2-Pentadiene	7 18
5		Penta-1,cis-3-diene	1,cis-3-Pentadiene	7 18
6		Penta-1,trans-3-diene	1,trans-3-Pentadiene	7 18
7		Penta-1,4-diene	1,4-Pentadiene	7 18
8		Penta-2,3-diene	2,3-Pentadiene	7 18
9		3-Methylbuta-1,2-diene	3-Methyl-1,2-butadiene	7 18
10		2-Methylbuta-1,3-diene	2-Methyl-1,3-butadiene	7 18
C₆ ALKADIENES				
11	C ₆ H ₁₀	Hexa-1,2-diene	1,2-Hexadiene	8 19
12		Hexa-1,cis-3-diene	1,cis-3-Hexadiene	8 19
13		Hexa-1,trans-3-diene	1,trans-3-Hexadiene	8 19
14		Hexa-1,cis-4-diene	1,cis-4-Hexadiene	8 19
15		Hexa-1,trans-4-diene	1,trans-4-Hexadiene	8 19
16		Hexa-1,5-diene	1,5-Hexadiene	8 19
17		Hexa-2,3-diene	2,3-Hexadiene	9 20
18		Hexa-cis-2,cis-4-diene	cis-2,cis-4-Hexadiene	9 20
19		Hexa-cis-2,trans-4-diene	cis-2,trans-4-Hexadiene	9 20
20		Hexa-trans-2,trans-4-diene	trans-2,trans-4-Hexadiene	9 20
21		3-Methylpenta-1,2-diene	3-Methyl-1,2-pentadiene	10 21
22		4-Methylpenta-1,2-diene	4-Methyl-1,2-pentadiene	10 21
23		2-Methylpenta-1,cis-3-diene	2-Methyl-1,cis-3-pentadiene	10 21
24		2-Methylpenta-1,trans-3-diene	2-Methyl-1,trans-3-pentadiene	10 21
25		3-Methylpenta-1,cis-3-diene	3-Methyl-1,cis-3-pentadiene	10 21
26		3-Methylpenta-1,trans-3-diene	3-Methyl-1,trans-3-pentadiene	10 21
27		4-Methylpenta-1,3-diene	4-Methyl-1,3-pentadiene	10 21
28		2-Methylpenta-1,4-diene	2-Methyl-1,4-pentadiene	11 22
29		3-Methylpenta-1,4-diene	3-Methyl-1,4-pentadiene	11 22
30		2-Methylpenta-2,3-diene	2-Methyl-2,3-pentadiene	11 22
31		2-Ethylbuta-1,3-diene	2-Ethyl-1,3-butadiene	11 22
32		2,3-Dimethylbuta-1,3-diene	2,3-Dimethyl-1,3-butadiene	11 22
C₆ ALKATRIENES				
33	C ₆ H ₈	Hexa-1,cis-3,5-triene	1,cis-3,5-Hexatriene	11 22

TABLE 1

LIST of COMPOUNDS continued

The Empirical Formula, Name, Alternative Name, if any, and location of the Tables giving the Orthobaric Liquid Density, d , and the Orthobaric Liquid Molar Volume, V_m , for each compound considered in this Data Item are as follows.

No.	Emp. Form.	Name	Alternative Names	Table Pages d V_m
C₂ and C₃ ALKYNES				
34	C ₂ H ₂	Acetylene	Ethyne	12 23
35	C ₃ H ₄	Propyne	Allylene	12 23
			Methylacetylene	
C₄ ALKYNES				
36	C ₄ H ₆	But-1-yne	1-Butyne	12 23
37		But-2-yne	2-Butyne	12 23
			Ethylacetylene	
			Dimethylacetylene	
C₅ ALKYNES				
38	C ₅ H ₈	Pent-1-yne	1-Pentyne	12 23
39		Pent-2-yne	2-Pentyne	12 23
40		3-Methylbut-1-yne	3-Methyl-1-butyne	12 23
			Propylacetylene	
C₆ ALKYNES				
41	C ₆ H ₁₀	Hex-1-yne	1-Hexyne	13 24
42		Hex-2-yne	2-Hexyne	13 24
43		Hex-3-yne	3-Hexyne	13 24
44		3-Methylpent-1-yne	3-Methyl-1-pentyne	13 24
45		4-Methylpent-1-yne	4-Methyl-1-pentyne	13 24
46		4-Methylpent-2-yne	4-Methyl-2-pentyne	13 24
47		3,3-Dimethylbut-1-yne	3,3-Dimethyl-1-butyne	13 24
			Butylacetylene	
			Diethylacetylene	
C₇ ALKYNES				
48	C ₇ H ₁₂	Hept-1-yne	1-Heptyne	14 25
49		Hept-2-yne	2-Heptyne	14 25
50		Hept-3-yne	3-Heptyne	14 25
51		3-Methylhex-1-yne	3-Methyl-1-hexyne	14 25
52		4-Methylhex-1-yne	4-Methyl-1-hexyne	14 25
53		5-Methylhex-1-yne	5-Methyl-1-hexyne	14 25
54		4-Methylhex-2-yne	4-Methyl-2-hexyne	15 26
55		5-Methylhex-2-yne	5-Methyl-2-hexyne	15 26
56		2-Methylhex-3-yne	2-Methyl-3-hexyne	15 26
57		3-Ethylpent-1-yne	3-Ethyl-1-pentyne	15 26
58		3,3-Dimethylpent-1-yne	3,3-Dimethyl-1-pentyne	15 26
59		3,4-Dimethylpent-1-yne	3,4-Dimethyl-1-pentyne	15 26
60		4,4-Dimethylpent-1-yne	4,4-Dimethyl-1-pentyne	15 26
61		4,4-Dimethylpent-2-yne	4,4-Dimethyl-2-pentyne	15 26
C₈ ALKYNES				
62	C ₈ H ₁₄	Oct-1-yne	1-Octyne	16 27
63		Oct-2-yne	2-Octyne	16 27
64		Oct-3-yne	3-Octyne	16 27
65		Oct-4-yne	4-Octyne	16 27
			Dipropylacetylene	
ALKENYNES and ALKADIYNES				
66	C ₄ H ₄	But-1-en-3-yne	1-Buten-3-yne	16 27
67	C ₄ H ₂	Buta-1,3-diyne	1,3-Butadiyne	16 27
68	C ₆ H ₆	Hexa-1,5-dien-3-yne	1,5-Hexadien-3-yne	16 27
69		Hexa-1,5-diyne	1,5-Hexadiyne	16 27
			Vinylacetylene	
			Diacetylene	
			Divinylacetylene	

TABLE 2

CONSTANTS in EQUATION (1)

This Table lists the constants for each compound that, when used in Equation (1) give the Orthobaric Liquid Density, d , and the Orthobaric Liquid Molar Volume, V_m , given on pages 6 to 16 and pages 17 to 27 respectively.

No.	Name	T_c K	d_c kg/m ³	a_1	a_2	a_3	a_4
C₃ ALKADIENES							
1	Propadiene	392.15	243	1.65638	-0.34991	-0.35038	0.37760
C₄ ALKADIENES							
2	Buta-1,2-diene	452.15	246	1.68309	-0.36143	-0.38740	0.41309
3	Buta-1,3-diene	425.17	245	1.66205	-0.38573	-0.30859	0.36814
C₅ ALKADIENES							
4	Penta-1,2-diene	491.15	248	1.72504	-0.37952	-0.44556	0.46884
5	Penta-1,cis-3-diene	490.15	248	1.72058	-0.37759	-0.43936	0.46291
6	Penta-1,trans-3-diene	487.15	248	1.66372	-0.35308	-0.36057	0.38736
7	Penta-1,4-diene	462.15	248	1.66768	-0.35478	-0.36604	0.39261
8	Penta-2,3-diene	497.15	248	1.71924	-0.37702	-0.43751	0.46113
9	3-Methylbuta-1,2-diene	489.15	255	1.61987	-0.33415	-0.29978	0.32909
10	2-Methylbuta-1,3-diene	479.15	255	1.62509	-0.33642	-0.30701	0.33602
C₆ ALKADIENES							
11	Hexa-1,2-diene	526.15	248	1.73485	-0.38375	-0.45915	0.48187
12	Hexa-1,cis-3-diene	522.15	248	1.71497	-0.37518	-0.43160	0.45546
13	Hexa-1,trans-3-diene	520.15	248	1.70892	-0.37256	-0.42320	0.44741
14	Hexa-1,cis-4-diene	512.15	248	1.70311	-0.37006	-0.41515	0.43969
15	Hexa-1,trans-4-diene	510.15	248	1.69971	-0.36860	-0.41044	0.43517
16	Hexa-1,5-diene	501.15	248	1.70644	-0.37151	-0.41977	0.44412
17	Hexa-2,3-diene	514.15	248	1.61585	-0.33257	-0.29397	0.32362
18	Hexa-cis-2,cis-4-diene	540.15	248	1.78373	-0.40490	-0.52679	0.54677
19	Hexa-cis-2,trans-4-diene	537.15	248	1.74434	-0.38772	-0.47253	0.49460
20	Hexa-trans-2,trans-4-diene	536.15	248	1.71505	-0.37523	-0.43170	0.45556
21	3-Methylpenta-1,2-diene	523.15	255	1.66114	-0.35182	-0.35725	0.38407
22	4-Methylpenta-1,2-diene	521.15	255	1.63697	-0.34160	-0.32337	0.35175
23	2-Methylpenta-1,cis-3-diene	530.15	255	1.68238	-0.36116	-0.38636	0.41211
24	2-Methylpenta-1,trans-3-diene	530.15	255	1.68238	-0.36116	-0.38636	0.41211
25	3-Methylpenta-1,cis-3-diene	534.15	255	1.71930	-0.37685	-0.43794	0.46139
26	3-Methylpenta-1,trans-3-diene	534.15	255	1.71930	-0.37685	-0.43794	0.46139
27	4-Methylpenta-1,3-diene	532.15	255	1.66009	-0.35149	-0.35556	0.38255
28	2-Methylpenta-1,4-diene	500.15	255	1.62634	-0.33713	-0.30843	0.33752
29	3-Methylpenta-1,4-diene	500.15	255	1.63060	-0.33914	-0.31404	0.34302
30	2-Methylpenta-2,3-diene	524.15	255	1.64286	-0.34407	-0.33167	0.35966
31	2-Ethylbuta-1,3-diene	531.15	255	1.65150	-0.34810	-0.34310	0.37084
32	2,3-Dimethylbuta-1,3-diene	525.15	262	1.62561	-0.33665	-0.30774	0.33672
C₆ ALKATRIENES							
33	Hexa-1,cis-3,5-triene	540.15	258	1.83753	-0.42772	-0.60204	0.61861

TABLE 2 continued

CONSTANTS in EQUATION (1) continued

This Table lists the constants for each compound that, when used in Equation (1) give the Orthobaric Liquid Density, d , and the Orthobaric Liquid Molar Volume, V_m , given on pages 6 to 16 and pages 17 to 27 respectively.

No.	Name	T_c K	d_c kg/m ³	a_1	a_2	a_3	a_4
C ₂ and C ₃ ALKYNES							
34	Acetylene	308.32	237	1.54526	-0.30203	-0.19630	0.22991
35	Propyne	402.39	241	1.77297	-0.39854	-0.51501	0.53411
C ₄ ALKYNES							
36	But-1-yne	443.15	246	1.72968	-0.38128	-0.45242	0.47523
37	But-2-yne	473.15	246	1.78969	-0.40744	-0.53507	0.55469
C ₅ ALKYNES							
38	Pent-1-yne	481.15	248	1.75729	-0.39353	-0.49006	0.51158
39	Pent-2-yne	505.15	248	1.76373	-0.39616	-0.49925	0.52028
40	3-Methylbut-1-yne	463.15	255	1.63498	-0.34076	-0.32057	0.34909
C ₆ ALKYNES							
41	Hex-1-yne	516.15	248	1.75659	-0.39317	-0.48920	0.51071
42	Hex-2-yne	535.15	248	1.78220	-0.40431	-0.52453	0.54465
43	Hex-3-yne	531.15	248	1.75523	-0.39237	-0.48770	0.50912
44	3-Methylpent-1-yne	514.15	255	1.63444	-0.34053	-0.31984	0.34838
45	4-Methylpent-1-yne	517.15	255	1.63200	-0.33952	-0.31637	0.34509
46	4-Methylpent-2-yne	536.15	255	1.63751	-0.34150	-0.32473	0.35279
47	3,3-Dimethylbut-1-yne	488.15	262	1.46343	-0.26694	-0.08252	0.12099
C ₇ ALKYNES							
48	Hept-1-yne	547.15	249	1.75267	-0.39183	-0.48313	0.50517
49	Hept-2-yne	564.15	249	1.77984	-0.40275	-0.52224	0.54205
50	Hept-3-yne	557.15	249	1.75457	-0.39191	-0.48710	0.50840
51	3-Methylhex-1-yne	530.15	255	1.66080	-0.35186	-0.35644	0.38344
52	4-Methylhex-1-yne	539.15	255	1.69906	-0.36795	-0.41021	0.43467
53	5-Methylhex-1-yne	538.15	255	1.68050	-0.36059	-0.38332	0.40939
54	4-Methylhex-2-yne	551.15	255	1.69930	-0.36850	-0.40973	0.43456
55	5-Methylhex-2-yne	554.15	255	1.69081	-0.36483	-0.39796	0.42327
56	2-Methylhex-3-yne	543.15	255	1.66074	-0.35161	-0.35677	0.38358
57	3-Ethylpent-1-yne	530.15	255	1.69509	-0.36664	-0.40396	0.42900
58	3,3-Dimethylpent-1-yne	516.15	261	1.57901	-0.31647	-0.24329	0.27488
59	3,4-Dimethylpent-1-yne	528.15	261	1.61816	-0.33331	-0.29763	0.32694
60	4,4-Dimethylpent-1-yne	521.15	261	1.59467	-0.32300	-0.26538	0.29589
61	4,4-Dimethylpent-2-yne	532.15	261	1.58629	-0.31947	-0.25364	0.28469
C ₈ ALKYNES							
62	Oct-1-yne	574.15	250	1.74715	-0.38918	-0.47596	0.49809
63	Oct-2-yne	591.15	250	1.76724	-0.39772	-0.50404	0.52491
64	Oct-3-yne	584.15	250	1.75133	-0.39117	-0.48140	0.50345
65	Oct-4-yne	582.15	250	1.75011	-0.39060	-0.47982	0.50189
ALKENYNES and ALKADIYNES							
66	But-1-en-3-yne	443.15	260	1.69854	-0.36801	-0.40896	0.43369
67	Buta-1,3-diyne	453.15	278	1.58149	-0.31780	-0.24624	0.27790
68	Hexa-1,5-dien-3-yne	543.15	268	1.74906	-0.38983	-0.47891	0.50078
69	Hexa-1,5-diyne	543.15	268	1.79858	-0.41103	-0.54785	0.56675

TABLE 3(D)

ORTHOBARIC LIQUID DENSITY of C_3 and C_4 ALKADIENESUnits: kg/m^3 v. deg.C

1	C ₃ H ₄	Propadiene	Allene	
2	C ₄ H ₆	Buta-1,2-diene	1,2-Butadiene	
3		Buta-1,3-diene	1,3-Butadiene	
No.		1	2	3
t _f (deg.C)		-136	-136	-109
d _f (kg/m ³)		773.	811.	763.
t		d		
deg.C		kg/m ³		
-130		766.	805.	
-120		756.	796.	
-110		745.	786.	
-100		733.	776.	754.
-90		722.	766.	744.
-80		711.	756.	733.4
-70		700.	746.	722.8
-60		688.	736.	712.2
-50		676.	726.	701.5
-40		664.	716.	690.6
-30		652.	706.	679.6
-20		639.	695.	668.4
-10		627.	685.	656.9
0		613.	674.	645.3
10		600.	663.	633.3
20		585.	652.	621.1
30		570.	640.	608.4
40		554.	628.	595.3
50		538.	616.	581.7
60		519.	604.	567.5
70		499.	591.	552.4
80		477.	577.	536.5
90		451.	563.	519.3
100		420.	548.	501.
110		376.	532.	480.
120			514.	456.
130			495.	428.
140			474.	390.
150			449.	320.
160			418.	
170			376.	
t _c (deg.C)		119	179	152.02
d _c (kg/m ³)		243.	246.	245.

TABLE 4(D)
ORTHOBARIC LIQUID DENSITY of C₅ ALKADIENES

Units: kg/m³ v. deg.C

	4	C ₅ H ₈	Penta-1,2-diene	1,2-Pentadiene			
	5		Penta-1,cis-3-diene	1,cis-3-Pentadiene			
	6		Penta-1,trans-3-diene	1,trans-3-Pentadiene			
	7		Penta-1,4-diene	1,4-Pentadiene			
	8		Penta-2,3-diene	2,3-Pentadiene			
	9		3-Methylbuta-1,2-diene	3-Methyl-1,2-butadiene			
	10		2-Methylbuta-1,3-diene	2-Methyl-1,3-butadiene			
No.	4	5	6	7	8	9	10
t _f (deg.C)	-137	-141	-87	-148	-126	-114	-146
d _f (kg/m ³)	844.	846.	777.	827.	833.	810.	838.
t				d			
deg.C				kg/m ³			
-140		845.		819.			833.
-130	837.	835.		810.			823.
-120	828.	826.		800.	828.		814.
-110	818.	817.		791.	818.	807.	805.
-100	809.	807.		781.	809.	798.	796.
-90	800.	798.		772.	800.	789.	787.
-80	790.	789.	771.	762.	791.	780.	778.
-70	781.	779.	762.	753.	781.	771.	769.
-60	771.	770.	752.	743.	772.	762.	759.
-50	762.	760.	743.	733.	763.	753.	750.
-40	752.	750.	734.	723.	753.	744.	741.
-30	742.	741.	725.	713.	744.	734.	731.
-20	733.	731.	715.	703.	734.	725.	721.
-10	723.	721.	705.	693.	725.	715.	711.
0	713.0	711.3	695.8	682.2	714.8	705.8	701.5
10	702.9	701.3	686.0	671.6	705.0	696.0	691.4
20	692.74	691.08	676.04	660.75	694.98	686.06	681.09
30	682.40	680.73	665.90	649.70	684.86	675.94	670.60
40	671.9	670.2	655.6	638.4	674.6	665.6	659.9
50	661.1	659.5	645.0	626.7	664.1	655.1	648.9
60	650.2	648.5	634.2	614.8	653.4	644.3	637.7
70	638.9	637.2	623.1	602.4	642.4	633.2	626.1
80	627.4	625.6	611.7	589.5	631.2	621.8	614.1
90	615.5	613.7	599.9	576.0	619.6	610.0	601.7
100	603.	601.	588.	562.	608.	598.	589.
110	590.	588.	575.	547.	595.	585.	575.
120	577.	575.	561.	531.	582.	572.	561.
130	563.	561.	547.	514.	569.	558.	546.
140	548.	546.	532.	495.	554.	543.	530.
150	532.	530.	516.	474.	539.	527.	512.
160	514.	512.	499.	449.	523.	509.	493.
170	495.	493.	479.	419.	505.	490.	471.
180	474.	471.	457.	377.	485.	468.	445.
190	449.	445.	431.		462.	443.	413.
200	417.	413.	397.		435.	411.	364.
210	373.	366.	341.		401.	363.	
220					344.		
t _c (deg.C)	218	217	214	189	224	216	206
d _c (kg/m ³)	248.	248.	248.	248.	248.	255.	255.

TABLE 5(D)

ORTHOBARIC LIQUID DENSITY of C_6 ALKADIENES-IUnits: kg/m^3 v. deg.C

11	C_6H_{10}	Hexa-1,2-diene	1,2-Hexadiene			
12		Hexa-1,cis-3-diene	1,cis-3-Hexadiene			
13		Hexa-1,trans-3-diene	1,trans-3-Hexadiene			
14		Hexa-1,cis-4-diene	1,cis-4-Hexadiene			
15		Hexa-1,trans-4-diene	1,trans-4-Hexadiene			
16		Hexa-1,5-diene	1,5-Hexadiene			
No.	11	12	13	14	15	16
t_f (deg.C)			-102		-139	-141
d_f (kg/m^3)			815.		842.	844.
t deg.C			d kg/m^3			
-140	859.	851.		844.		843.
-130	850.	842.		835.	834.	834.
-120	841.	833.		826.	825.	825.
-110	832.	824.		818.	816.	815.
-100	823.	815.	813.	809.	807.	806.
-90	814.	807.	804.	800.	798.	797.
-80	805.	798.	795.	791.	789.	788.
-70	796.	789.	787.	782.	780.	779.
-60	788.	780.	778.	773.	771.	770.
-50	779.	771.	769.	764.	762.	761.
-40	770.	763.	760.	755.	753.	751.
-30	761.	754.	751.	746.	744.	742.
-20	752.	745.	742.	737.	735.	733.
-10	743.	736.	733.	728.	726.	723.
0	733.	726.	723.9	719.	716.7	713.8
10	724.	717.	714.7	709.	707.3	704.1
20	715.	708.	705.4	700.	697.8	694.3
30	705.	698.	695.94	690.	688.10	684.34
40	696.	689.	686.37	680.	678.30	674.24
50	686.	679.	676.6	670.	668.3	664.0
60	676.	669.	666.8	660.	658.2	653.5
70	666.	659.	656.7	650.	647.8	642.7
80	656.	649.	646.4	639.	637.2	631.7
90	646.	639.	635.9	629.	626.3	620.4
100	635.	628.	625.	617.	615.	609.
110	624.	617.	614.	606.	604.	597.
120	613.	605.	602.	594.	592.	584.
130	601.	593.	590.	582.	579.	571.
140	589.	581.	578.	569.	566.	557.
150	576.	568.	565.	555.	552.	542.
160	563.	555.	551.	541.	538.	526.
170	549.	540.	537.	525.	522.	509.
180	534.	525.	521.	508.	505.	491.
190	517.	508.	504.	490.	486.	469.
200	500.	490.	485.	469.	465.	445.
210	480.	469.	464.	445.	440.	414.
220	457.	445.	440.	416.	409.	370.
230	430.	416.	409.	375.	363.	
240	395.	375.	363.			
250	333.					
t_c (deg.C)	253	249	247	239	237	228
d_c (kg/m^3)	248.	248.	248.	248.	248.	248.