

AROMATIC HYDROCARBON TYPES IN DETERGENT ALKYLATES USING LOW VOLTAGE MASS SPECTROMETRY

UOP Method 672-84

SCOPE

This method is for determining the composition of aromatic hydrocarbon types and their carbon number distribution in detergent alkylates. Samples are principally composed of mono-*n*-alkylbenzenes having the empirical formula C_nH_{2n-6} and in a carbon number range from C_{15} – C_{22} . The method is particularly useful for determining the composition of the more hydrogen deficient aromatic types, C_nH_{2n-8} , etc., which may be present as impurities. However, it is also applicable to the characterization of heavy alkylate samples, which have a carbon number range from approximately C_{22} – C_{40} . Non-aromatic hydrocarbons in the finished product alkylate are not determined.

Calibration sensitivities are derived from concentrates which are representative of the average isomer distribution present in the alkylate. Since the sensitivities of some individual mass isomers differ from each other significantly and may vary due to changing processing conditions it is difficult to determine the absolute accuracy of the results. However, this method is useful to characterize impurities and indicate relative changes in concentration.

The hydrocarbon types are referred to by “Z number” or “negative constant” in the empirical formula subscript for hydrogen. Thus, “Z = 6” represents hydrocarbons with the formula C_nH_{2n-6} . The analysis yields arrays of Z numbers by carbon number expressed as mass percent.

OUTLINE OF METHOD

The composition of the aromatic alkylated products is determined by low ionization voltage, high resolution mass spectrometry, coupled with an on-line data acquisition and reduction system, based on the intensity of the parent ion peaks present in the mass spectrum. Spectra are obtained at a resolving power of 10,000 and at low ionizing voltages, ~11.5 eV from mass ~750 to 78. This resolving power is sufficient to separate mass multiplets of aromatic hydrocarbon types having different Z numbers but having the same nominal mass to molecular weight of ~750. The use of low voltage reduces the mass spectrum to essentially parent ion peaks and their ^{13}C isotopes. Calculations are made from sensitivity data provided in this method at each even-mass value using polyisotopic parent peaks for each homologous series and/or Z number. Each parent peak sensitivity represents the thermodynamic equilibrium distribution of mass isomers at each given molecular weight present in the alkylate. Results are expressed in mass percent.

IT IS THE USER'S RESPONSIBILITY TO ESTABLISH APPROPRIATE PRECAUTIONARY PRACTICES AND TO DETERMINE THE APPLICABILITY OF REGULATORY LIMITATIONS PRIOR TO USE. EFFECTIVE HEALTH AND SAFETY PRACTICES ARE TO BE FOLLOWED WHEN UTILIZING THIS PROCEDURE. FAILURE TO UTILIZE THIS PROCEDURE IN THE MANNER PRESCRIBED HEREIN CAN BE HAZARDOUS. MATERIAL SAFETY DATA SHEETS (MSDS) OR EXPERIMENTAL MATERIAL SAFETY DATA SHEETS (EMSDS) FOR ALL OF THE MATERIALS USED IN THIS PROCEDURE SHOULD BE REVIEWED FOR SELECTION OF THE APPROPRIATE PERSONAL PROTECTION EQUIPMENT (PPE).

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APPARATUS

Mass spectrometer, double beam instrument, Kratos Model MS-30, or equivalent

Data system, on-line with the mass spectrometer, Data General, Nova 4X Computer, or equivalent

REAGENTS AND MATERIALS

All reagents shall conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, when such specifications are available, unless otherwise specified. References to water shall mean deionized or distilled water. Unqualified references to solutions shall mean aqueous solutions unless otherwise stated.

Perfluorokerosine-H, PCR Inc., Cat. No. 12461, or equivalent

Pipets, 0.5- and 1- μ L, disposable, Drummond Scientific Co., or equivalent

Sample introduction system, Kratos Model WH-008, all Glass Heated Inlet System fitted with UOP⁽¹⁾ all glass sample introduction system, see Figs. 1 and 2 or equivalent. Temperature range of this system is from ambient to 375 C. However, any heated inlet system permitting the introduction of the sample without loss, contamination or change in composition may be used.

PREPARATION OF THE APPARATUS

No special preparation is required once the instrument is activated and tuned for optimum performance at 10,000 resolution according to the manufacturer's instruction. The specific instrument settings used to develop this method are listed in Table 1.

Table 1

Instrument Settings	
Magnet current	5.55 amps
Ion accelerating voltage	3,870 volts
Source slit, resolution, beams 1 & 2	10,000
Collector slit, resolution, beams 1 & 2	10,000
Multiplier voltage	~1600 volts
Scan rate	100 seconds/decade
Filament ionizing voltage*	~11.5 eV
Source temperature	200 C
Sample reservoir oven and inlet line	375 C
Sample introduction system	375 C
Mass reference material	Perfluorokerosine-H

* To assure that minimal fragmentation is achieved, the low ionizing voltage is further adjusted by scanning either xylene or *n*-octylbenzene. When xylene is used, the voltage is adjusted to reduce the intensity of the *m/z* 91 fragment so that it is ~1.5% of the *m/z* 106 parent intensity. For *n*-octylbenzene, the *m/z* 92 peak is ~35% of the *m/z* 190 parent peak intensity.

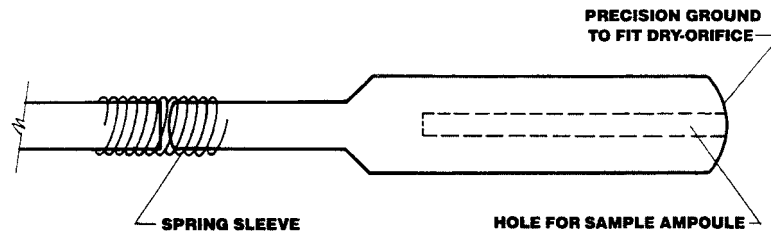


FIGURE 1
AMPOULE CAPILLARY PIPET

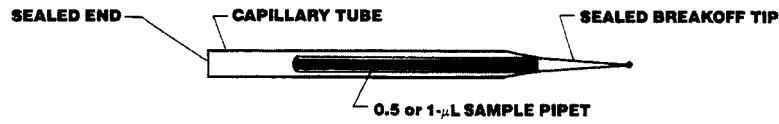


Figure 1
SEALED AMPOULE WITH SAMPLE PIPET

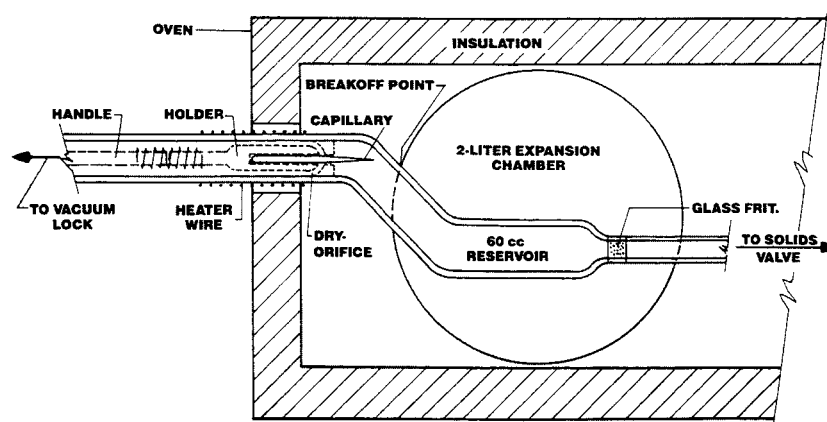


Figure 2
DRY-ORIFICE AND SAMPLE INLET
SYSTEM

CALIBRATION

Calibration sensitivity data for the calculation of mass-percent by carbon number and aromatic type are included in Table 4. Sensitivities are expressed in peak area/mg of sample. The accurate masses used for the identification of each Z number type from Z = 6 to 76 and by carbon number from C₆ to C₁₀₀ are included in Table 5. The extended sensitivity range for Z number, Z = 18+, and carbon number C₅₀+ were computer calculated from previously derived petroleum data in anticipation of possible future needs.

Background Performance Test

Samples in a carbon number range from C₁₄–C₂₅ should pump out so that less than 0.1% of the strongest peak observed in the previous spectrum remains. Pump out time is normally fifteen minutes. Heavy alkylate samples, C₂₅ to approximately C₅₀, normally require a one hour pump out time.

PROCEDURE

Mass spectrometers are generally in continuous operation and should require no additional preparation before introduction of the sample. If the spectrometer has been turned on only recently, it will be mandatory to check its operation according to the instructions of the manufacturer, and also as outlined in this method before proceeding, to ensure minimum fragmentation and sufficient stability at low ionizing operation.

Introduce the sample by means of a microburet, constant volume pipet, or the system developed at UOP⁽¹⁾ to obtain a spectrum of usable intensities over the carbon number range of the sample. For the alkylate product the upper end of this range is approximately C₂₅, and for the heavy alkylate approximately C₄₀.

CALCULATIONS

Alkylate Product

Qualitatively establish the carbon number distribution of the sample from the low voltage spectrum. By observation, the parent mono-*n*-alkylbenzene peaks, Z = 6, in the alkylate will increase in intensity from the highest carbon number, C₂₅, to C₁₇ and decrease to C₁₅, and then begin increasing again. The lowest value obtained determines the beginning of the carbon number series. All the parent ion peaks from C₆ to the minimum value are disregarded and assumed to be absent for not only Z = 6 but also for the Z = 8 and Z = 10 series. No parent peaks are disregarded for the Z = 12 and higher series, if present.

The C₁₅ peak intensity at m/z 204.1878 is corrected by subtracting the ¹³C isotope effect from the m/z 203.1800 fragment peak produced at 11.5 eV. The Correction is made by multiplying the total peak intensity at m/z 203 by the isotope correction factor 0.1658.⁽²⁾ The product obtained is subtracted from the 204 peak intensity and the remainder is due to the C₁₅ alkylate present. If the carbon number distribution changes, new isotope factors are used to correspond with the first carbon number of the Z = 6 series. Isotope corrections are not made for the higher carbon numbers in the Z = 6 series, since only a minimal amount of fragmentation occurs in this range.

The peak intensities are divided for each parent peak by the appropriate Z number sensitivities in Table 4 and normalized to 100%. The mass-percent carbon number obtained for each Z number series is reported in columns in ascending sequence. The Z numbers from 6 to 18 and some of their corresponding “suggested” hydrocarbon types are listed in Table 2. The names for the Z numbers above 18 are not given due to the large number of possible compounds that can be present, but instead are identified by their Z numbers only.

Table 2

Z No.	Suggested Aromatic Hydrocarbon Types
6	Mono-<i>n</i>-alkylbenzenes
8	Indans, Tetralins, Phenylalkenes
10	Dinaphthenebenzenes, Indenes
12	Naphthalenes, Trinaphthenobenzenes
14	Biphenyls, Acenaphthenes
16	Fluorenes, Dinaphthenonaphthalenes
18	Phenanthrenes, Anthracenes, Trinaphthenonaphthalenes
↓	
76	

Heavy Alkylate

Qualitatively establish the carbon number distribution of the sample from the low voltage spectrum as described for the alkylate product. All the parent ion peaks from C₆ to the minimum value are disregarded and assumed to be absent for all Z series from Z = 6 to Z = 20.

The intensities of the C₂₀–C₂₄ peaks for the Z = 6 series and the C₂₀ peak for the Z = 8 series are corrected by subtracting the ¹³C isotope effect from the corresponding fragment ion peaks produced at 11.5 eV. The corrections are made by multiplying the total peak intensities of the fragment ion by the appropriate isotope correction factor shown below.

Table 3

Fragment Ion	Correction Factor
m/z 273.2598	0.2212
m/z 287.2739	0.2324
m/z 301.2895	0.2435
m/z 315.3052	0.2547
m/z 329.3208	0.2658
m/z 271.2426	0.2210

PRECISION

Based on 10 replicates and 7 replicates, respectively, the estimated standard deviations (esd) for an alkylate product and a heavy alkylate have been calculated and are shown in Tables 6 and 7. Duplicate results by the same operator should not differ by more than the amounts shown in the “allowable difference” column (95% probability).

Table 6
Alkylate Product

Z Number	Level, mass-%	esd, mass-%	Allowable Difference, mass-%
6	95.8	0.3	1.0
8	2.2	0.2	0.6
10	0.2	0.1	0.3
12	0.6	0.1	0.3
14	0.8	0.1	0.3
16	0.3	0.1	0.3

Table 7
Heavy Alkylate

Z Number	Level, mass-%	esd, mass-%	Allowable Difference, mass-%
6	65.2	1.3	4.5
8	14.0	1.0	3.5
10	4.4	0.4	1.4
12	6.5	0.2	0.7
14	6.2	0.2	0.7
16	2.4	0.2	0.7
18	0.6	0.1	0.3
20	0.5	0.03	0.1
22	0.1	0.01	0.03

TIME FOR ANALYSIS

The total elapsed time and the labor requirement for the analysis of the alkylate product are identical, 2.5 hours.

The total elapsed time and the labor requirement for the analysis of the heavy alkylate are identical, 4 hours.

REFERENCES

1. Padrta, F. G., and Donohue, J.J., *Anal. Chem.*, **42**, 950 (1970).
2. McAdams, D.R., "Isotope Correction Factors for Mass Spectra of Petroleum Fractions," Esso Research Laboratories, Baton Rouge, LA (October, 1957).

SUGGESTED SUPPLIERS

Data General Corp., Westboro, MA 01581
 Drummond Scientific Co., Broomall, PA 19008
 Kratos Scientific Instruments, Inc., 170 Williams Dr., Ramsey, NJ 07446
 PCR Inc., P.O. Box 1466, Gainesville, FL 32601

Table 4
Pacol Alkylbenzene Calibrations

C No.	Z=6	Z=8	Z=10	Z=12	Z=14	Z=16	Z=18	Z=20	Z=22	Z=24	Z=26	Z=28	Z=30	Z=32
C 6	25000.													
C 7	30500.													
C 8	34000.													
C 9	35500.	30000.	50000.			95000.	138650.	128400.	117750.	96250.	110000.	82500.	90000.	70750.
C 10	36000.	32500.	57500.	72000.	50000.	57500.	106220.	98880.	94500.	80750.	69500.	69000.	75000.	59000.
C 11	34500.	33000.	61500.	72500.		79414.	84600.	80400.	80000.	70000.	60000.	61000.	70000.	55000.
C 12	30000.	32500.	63000.	72000.		48242.	70500.	68880.	68250.	61750.	50500.	54000.	58250.	49000.
C 13	25000.	32000.	62500.	71500.		33547.	61100.	56400.	56750.	45000.	45000.	43988.	48250.	45250.
C 14	20000.	30100.	61000.	69000.		29242.	50325.	49200.	49000.	36250.	35250.	40200.	44500.	42500.
C 15	18000.	29500.	57000.	65000.		25977.	43945.	43200.	43000.	30775.	32600.	37063.	42000.	41250.
C 16	15800.	27700.	52500.	61100.		33015.	38880.	38880.	37500.	28625.	30025.	34375.	38250.	39000.
C 17	13440.	26300.	46000.	52800.		19148.	31725.	34320.	39000.	26650.	28250.	31938.	35000.	35750.
C 18	12020.	24000.	40500.	48000.		17516.	29140.	31440.	34250.	25000.	26400.	29788.	32000.	32500.
C 19	10600.	22700.	35500.	43200.		16180.	27025.	29280.	32000.	23425.	24800.	28025.	29250.	30763.
C 20	9700.	21300.	31000.	40000.		14992.	25145.	27360.	29500.	20750.	23425.	26313.	27875.	28975.
C 21	9000.	20000.	29000.	36000.		13805.	23030.	25200.	27250.	19738.	22063.	24813.	26263.	27263.
C 22	7800.	19000.	27000.	33000.		12766.	20915.	23280.	23250.	18738.	20813.	23375.	24800.	25725.
C 23	7500.	17000.	25000.	31000.		11875.	19975.	22080.	23750.	19813.	19813.	22200.	23475.	24275.
C 24	7000.	15000.	23000.	29000.		10984.	18565.	20400.	22500.	18800.	18800.	21013.	22250.	23000.
C 25	6500.	13000.	21000.	27000.		10242.	17637.	19200.	20750.	17775.	17988.	20013.	21175.	21875.
C 26	6000.	12500.	19750.	25000.		9856.	16626.	18168.	19925.	16188.	17175.	19075.	20163.	20763.
C 27	5600.	12000.	18500.	23000.		9337.	15698.	17112.	18775.	15463.	16400.	18225.	19225.	19850.
C 28	5200.	11500.	17250.	21000.		8795.	14817.	16272.	17775.	14750.	15688.	17325.	18363.	18988.
C 29	4800.	11000.	16750.	20500.		8357.	14088.	15360.	16825.	14250.	14988.	16525.	17513.	18125.
C 30	4600.	10000.	15500.	20000.		7927.	13383.	14628.	16000.	13525.	14275.	15825.	16775.	17350.
C 31	4400.	9500.	15000.	19500.		7570.	12702.	13932.	15225.	12975.	13750.	15213.	16038.	16575.
C 32	4200.	9000.	15000.	19000.		7207.	12173.	13308.	14488.	12488.	13225.	14525.	15450.	15938.
C 33	4000.	8000.	14250.	18500.		6888.	11656.	12744.	13788.	11975.	12725.	14000.	14775.	15275.
C 34	3800.	7500.	13750.	18000.		6598.	11139.	12204.	13200.	11525.	12200.	13500.	14250.	14725.
C 35	3600.	7000.	13250.	17500.		6346.	10669.	11712.	12563.	11100.	11763.	12988.	13738.	14175.
C 36	3400.	6800.	12850.	17000.		6071.	10305.	11160.	12075.	10725.	11350.	12500.	13213.	13700.
C 37	3200.	6600.	12450.	16500.		5819.	9870.	10740.	11575.	10275.	10988.	12038.	12750.	13213.
C 38	3000.	6200.	12100.	16000.		5636.	9400.	10308.	11138.	9975.	10538.	11700.	12275.	12750.
C 39	2900.	5800.	11650.	15500.		5362.	9118.	10080.	10725.	9613.	10275.	11700.	12275.	12750.
C 40	2800.	5600.	11300.	15000.		5210.	8730.	9588.	10313.	9975.	10538.	11700.	12275.	12750.
C 41	2700.	5400.	10950.	14500.		5047.	8460.	9192.	10000.	9613.	10275.	11700.	12275.	12750.
C 42	2583.	4925.	10407.	13842.		4891.	8190.	8904.	9613.	9975.	10538.	11700.	12275.	12750.
C 43	2467.	4693.	9934.	13210.		4743.	7896.	8640.	9263.	9975.	10538.	11700.	12275.	12750.
C 44	2350.	4498.	9483.	12669.										
C 45	2267.	4340.	9058.	12177.										
C 46	2194.	4132.	8751.	11708.										
C 47	2100.	3962.	8419.	11261.										
C 48	2011.	3876.	8090.	10864.										
C 49	1956.	3706.	7901.	10417.										
C 50	1883.	3620.	7569.	10111.										

Table 4. (continued)

Pacol Alkylbenzene Calibrations														
C No.	Z=34	Z=36	Z=38	Z=40	Z=42	Z=44	Z=46	Z=48	Z=50	Z=52	Z=54	Z=56	Z=58	Z=60
C 6		62250.												
C 7		57250.												
C 8		51250.												
C 9		48250.			53750.									
C 10		43250.		58250.	50500.									
C 11		38250.		45000.	46750.									
C 12		36488.		41000.	41000.									
C 13		34225.		38600.	38600.									
C 14		31750.		31650.	35975.									
C 15		30025.		29738.	33750.									
C 16		28388.		28013.	31800.									
C 17		26813.		26513.	30013.									
C 18		25425.		25088.	28375.									
C 19		24125.		23825.	26950.									
C 20		22950.		22625.	25550.									
C 21		21950.		21538.	24263.									
C 22		20963.		20513.	23225.									
C 23		20000.		19650.	22213.									
C 24		19125.		18750.	21225.									
C 25		18300.		18000.	20350.									
C 26		17563.		17250.	19513.									
C 27		16938.		16550.	18738.									
C 28		16250.		15975.	18013.									
C 29		15738.		15275.	17313.									
C 30		15125.		14750.	16700.									
C 31		14575.		14225.	16075.									
C 32		14050.		13738.	15500.									
C 33														
C 34														
C 35														
C 36														
C 37														
C 38														
C 39														
C 40														
C 41														
C 42														
C 43														
C 44														
C 45														
C 46														
C 47														
C 48														
C 49														
C 50														

Table 4 (continued)
Pacol Alkylbenzene Calibrations

C No.	<u>Z=62</u>	<u>Z=64</u>	<u>Z=66</u>	<u>Z=68</u>	<u>Z=70</u>	<u>Z=72</u>	<u>Z=74</u>	<u>Z=76</u>
C 6								
C 7								
C 8								
C 9								
C 10								
C 11								
C 12								
C 13								
C 14								
C 15								
C 16								
C 17								
C 18								
C 19								
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C 25								
C 26								
C 27								
C 28								
C 29								
C 30								
C 31								
C 32								
C 33								
C 34								
C 35								
C 36								
C 37								
C 38	25550.							
C 39	24263.							
C 40	23225.	23225.	23225.					
C 41	22213.	22213.	22213.					
C 42	21225.	21225.	21225.	21225.	21225.			
C 43	20350.	20350.	20350.	20350.	20350.			
C 44	19513.	19513.	19513.	19513.	19513.	19513.		
C 45	18738.	18738.	18738.	18738.	18738.	18738.		
C 46	18013.	18013.	18013.	18013.	18013.	18013.	18013.	18013.
C 47	17313.	17313.	17313.	17313.	17313.	17313.	17313.	17313.
C 48	16700.	16700.	16700.	16700.	16700.	16700.	16700.	16700.
C 49	16075.	16075.	16075.	16075.	16075.	16075.	16075.	16075.
C 50	15500.	15500.	15500.	15500.	15500.	15500.	15500.	15500.

Pacol Alkylbenzene Callibrations

C. No.	Z=6	Z=8	Z=10	Z=12	Z=14	Z=16	Z=18	Z=20	Z=22	Z=24	Z=26	Z=28	Z=30	Z=32
C 51	1806.	3486.	7332.	9808.	5104.	4438.	7391.	8064.	8700.	9550.	10238.	11250.	11925.	12338.
C 52	1772.	3401.	7073.	9407.	4933.	4290.	7121.	7860.	8438.	9275.	9925.	10900.	11500.	11975.
C 53	1700.	3267.	6859.	9172.	4753.	4141.	6956.	7608.	8200.	9013.	9525.	10525.	11150.	11538.
C 54	1661.	3169.	6622.	8869.	4611.	4008.	6756.	7344.	7900.	8738.	9250.	10238.	10763.	11238.
C 55	1611.	3084.	6482.	8540.	4478.	3896.	6545.	7176.	7638.	8475.	9000.	9925.	10488.	10850.
C 56	1567.	2974.	6197.	8351.	4259.	3783.	6333.	6936.	7463.	8213.	8738.	9588.	10150.	10525.
C 57	1533.	2913.	6079.	7999.	4259.	3696.	6134.	6720.	7213.	7988.	8475.	9263.	9813.	10225.
C 58	1467.	2840.	5913.	7765.	4136.	3377.	5957.	6492.	7000.	7725.	8238.	9013.	9538.	9963.
C 59	2139.	5699.	2730.	7507.	3985.	3473.	5828.	6336.	6775.	7500.	8000.	8763.	9275.	9613.
C 60	1400.	2670.	5628.	7296.	3870.	3399.	5652.	5400.	6600.	7313.	7738.	8513.	9025.	9313.
C 61	1367.	2584.	5440.	7084.	3776.	3273.	5488.	5988.	6475.	7125.	7550.	8250.	8763.	9063.
C 62	1333.	2499.	5251.	6967.	3624.	3206.	5382.	5808.	6250.	6950.	7400.	8013.	8525.	8813.
C 63	1311.	2450.	5181.	6709.	3568.	3117.	5194.	5688.	6088.	6750.	7200.	7775.	8275.	8563.
C 64	1261.	2426.	5063.	6569.	3453.	3013.	5111.	5520.	5950.	6588.	6988.	7563.	8063.	8325.
C 65	1233.	2389.	4919.	6474.	3377.	2961.	4935.	5340.	5750.	6438.	6788.	7438.	7875.	8125.
C 66	1217.	2304.	4826.	6194.	3273.	2880.	4794.	5256.	5625.	6250.	6625.	7200.	7688.	7938.
C 67	1183.	2231.	4730.	6077.	3215.	2813.	4700.	5088.	5488.	6088.	6475.	7000.	7488.	7738.
C 68	1133.	2182.	4682.	5960.	3140.	2731.	4547.	5004.	5325.	5950.	6300.	6825.	7250.	7500.
C 69	1111.	2145.	4516.	5820.	3035.	2664.	4465.	4812.	5225.	5775.	6213.	6675.	7063.	7300.
C 70	1100.	2109.	4376.	5631.	2979.	2613.	4312.	4752.	5063.	5675.	6013.	6475.	6950.	7150.
C 71	1078.	2060.	4305.	5536.	2865.	2531.	4230.	4608.	4988.	5500.	5938.	6288.	6750.	6988.
C 72	1056.	1999.	4209.	5396.	2837.	2501.	4183.	4548.	4950.	5375.	5800.	6200.	6575.	6800.
C 73	1022.	1963.	4161.	5207.	2760.	2420.	4054.	4428.	4775.	5250.	5688.	6013.	6463.	6650.
C 74	944.	1938.	4021.	5139.	2694.	2368.	3983.	4320.	4688.	5100.	5500.	5888.	6275.	6500.
C 75	983.	1902.	3925.	5067.	2638.	2316.	3878.	4212.	4538.	5013.	5375.	5513.	6000.	6350.
C 76	972.	1865.	3832.	4881.	2580.	2256.	3784.	4104.	4475.	4975.	5275.	5613.	6138.	6350.
C 77	922.	1816.	3784.	4738.	2514.	2219.	3725.	4032.	4350.	4775.	5175.	5488.	5900.	6075.
C 78	911.	1755.	3736.	4692.	2447.	2197.	3596.	3972.	4263.	4700.	5013.	5325.	5750.	5963.
C 79	894.	1707.	3688.	4647.	2409.	2123.	3537.	3852.	4213.	4575.	4975.	5250.	5750.	5800.
C 80	883.	1694.	3644.	4598.	2324.	2078.	3502.	3816.	4075.	4500.	4863.	5125.	5500.	5700.
C 81	867.	1682.	3548.	4458.	2287.	2056.	3408.	3744.	4000.	4450.	4750.	5025.	5400.	5550.
C 82	856.	1670.	3500.	4340.	2258.	2011.	3337.	3648.	3938.	4313.	4700.	4975.	5275.	5475.
C 83	828.	1609.	3429.	4269.	2238.	1952.	3278.	3600.	3850.	4238.	4538.	4825.	5213.	5325.
C 84	817.	1560.	3359.	4200.	2182.	1930.	3231.	3552.	3750.	4188.	4488.	4750.	5038.	5250.
C 85	800.	1536.	3311.	4669.	2125.	1907.	3149.	3468.	3725.	4050.	4375.	4638.	4988.	5100.
C 86	789.	1512.	3241.	4128.	1096.	1863.	3079.	3384.	3625.	4000.	4275.	4525.	4913.	5000.
C 87	778.	1487.	3193.	4034.	2078.	1811.	3032.	3360.	3561.	3938.	4238.	4475.	4750.	4950.
C 88	772.	1463.	3171.	3966.	2030.	1789.	2996.	3312.	3500.	3825.	4188.	4375.	4688.	4825.
C 89	767.	1451.	3123.	3848.	1954.	1766.	2966.	3192.	3325.	3725.	4000.	4238.	4500.	4700.
C 90	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 91	750.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 92	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 93	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 94	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 95	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 96	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 97	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 98	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C 99	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.
C100	756.	1438.	3097.	3799.	1916.	1752.	2844.	3132.	3325.	3725.	4000.	4238.	4500.	4700.

Table 4 (continued)
Pacol Alkylbenzene Calibrations

C No.	Z=34	Z=36	Z=38	Z=40	Z=42	Z=44	Z=46	Z=48	Z=50	Z=52	Z=54	Z=56	Z=58	Z=60
C 51	13563.	13250.	14963.	14963.	14963.	14963.	14963.	14963.	14963.	14963.	14963.	14963.	14963.	14963.
C 52	13200.	12825.	14463.	14463.	14463.	14463.	14463.	14463.	14463.	14463.	14463.	14463.	14463.	14463.
C 53	12750.	12400.	13975.	13975.	13975.	13975.	13975.	13975.	13975.	13975.	13975.	13975.	13975.	13975.
C 54	12325.	12013.	13538.	13538.	13538.	13538.	13538.	13538.	13538.	13538.	13538.	13538.	13538.	13538.
C 55	11963.	11713.	13100.	13100.	13100.	13100.	13100.	13100.	13100.	13100.	13100.	13100.	13100.	13100.
C 56	11563.	11263.	12725.	12725.	12725.	12725.	12725.	12725.	12725.	12725.	12725.	12725.	12725.	12725.
C 57	11250.	10988.	12363.	12363.	12363.	12363.	12363.	12363.	12363.	12363.	12363.	12363.	12363.	12363.
C 58	10975.	10725.	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.
C 59	10700.	10375.	11688.	11688.	11688.	11688.	11688.	11688.	11688.	11688.	11688.	11688.	11688.	11688.
C 60	10313.	10063.	11325.	11325.	11325.	11325.	11325.	11325.	11325.	11325.	11325.	11325.	11325.	11325.
C 61	10013.	9813.	11050.	11050.	11050.	11050.	11050.	11050.	11050.	11050.	11050.	11050.	11050.	11050.
C 62	9763.	9563.	10750.	10750.	10750.	10750.	10750.	10750.	10750.	10750.	10750.	10750.	10750.	10750.
C 63	9525.	9275.	10488.	10488.	10488.	10488.	10488.	10488.	10488.	10488.	10488.	10488.	10488.	10488.
C 64	9263.	9038.	10225.	10225.	10225.	10225.	10225.	10225.	10225.	10225.	10225.	10225.	10225.	10225.
C 65	9025.	8775.	9975.	9975.	9975.	9975.	9975.	9975.	9975.	9975.	9975.	9975.	9975.	9975.
C 66	8763.	8588.	9688.	9688.	9688.	9688.	9688.	9688.	9688.	9688.	9688.	9688.	9688.	9688.
C 67	8563.	8350.	9450.	9450.	9450.	9450.	9450.	9450.	9450.	9450.	9450.	9450.	9450.	9450.
C 68	8325.	8200.	9225.	9225.	9225.	9225.	9225.	9225.	9225.	9225.	9225.	9225.	9225.	9225.
C 69	8188.	7975.	8975.	8975.	8975.	8975.	8975.	8975.	8975.	8975.	8975.	8975.	8975.	8975.
C 70	7963.	7738.	8750.	8750.	8750.	8750.	8750.	8750.	8750.	8750.	8750.	8750.	8750.	8750.
C 71	7750.	7513.	8513.	8513.	8513.	8513.	8513.	8513.	8513.	8513.	8513.	8513.	8513.	8513.
C 72	7513.	7338.	8300.	8300.	8300.	8300.	8300.	8300.	8300.	8300.	8300.	8300.	8300.	8300.
C 73	7425.	7225.	8100.	8100.	8100.	8100.	8100.	8100.	8100.	8100.	8100.	8100.	8100.	8100.
C 74	7225.	7000.	7950.	7950.	7950.	7950.	7950.	7950.	7950.	7950.	7950.	7950.	7950.	7950.
C 75	7025.	6850.	7738.	7738.	7738.	7738.	7738.	7738.	7738.	7738.	7738.	7738.	7738.	7738.
C 76	6875.	6725.	7525.	7525.	7525.	7525.	7525.	7525.	7525.	7525.	7525.	7525.	7525.	7525.
C 77	6725.	6525.	7450.	7450.	7450.	7450.	7450.	7450.	7450.	7450.	7450.	7450.	7450.	7450.
C 78	6538.	6400.	7225.	7225.	7225.	7225.	7225.	7225.	7225.	7225.	7225.	7225.	7225.	7225.
C 79	6475.	6250.	7063.	7063.	7063.	7063.	7063.	7063.	7063.	7063.	7063.	7063.	7063.	7063.
C 80	6263.	6150.	6963.	6963.	6963.	6963.	6963.	6963.	6963.	6963.	6963.	6963.	6963.	6963.
C 81	6188.	5988.	6763.	6763.	6763.	6763.	6763.	6763.	6763.	6763.	6763.	6763.	6763.	6763.
C 82	6000.	5850.	6638.	6638.	6638.	6638.	6638.	6638.	6638.	6638.	6638.	6638.	6638.	6638.
C 83	5938.	5750.	6488.	6488.	6488.	6488.	6488.	6488.	6488.	6488.	6488.	6488.	6488.	6488.
C 84	5775.	5600.	6350.	6350.	6350.	6350.	6350.	6350.	6350.	6350.	6350.	6350.	6350.	6350.
C 85	5725.	5500.	6250.	6250.	6250.	6250.	6250.	6250.	6250.	6250.	6250.	6250.	6250.	6250.
C 86	5563.	5375.	6100.	6100.	6100.	6100.	6100.	6100.	6100.	6100.	6100.	6100.	6100.	6100.
C 87	5475.	5263.	5988.	5988.	5988.	5988.	5988.	5988.	5988.	5988.	5988.	5988.	5988.	5988.
C 88	5325.	5188.	5900.	5900.	5900.	5900.	5900.	5900.	5900.	5900.	5900.	5900.	5900.	5900.
C 89	5250.	5025.	5750.	5750.	5750.	5750.	5750.	5750.	5750.	5750.	5750.	5750.	5750.	5750.
C 90	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 91	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 92	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 93	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 94	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 95	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 96	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 97	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 98	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 99	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C100	5188.	4988.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.

Pacol Alkylbenzene Calibrations

C. No.	2=62	2=64	2=66	2=68	2=70	2=72	2=74	2=76
C 51	14963.	14963.	14963.	14963.	14963.	14963.	14963.	14963.
C 52	14463.	14463.	14463.	14463.	14463.	14463.	14463.	14463.
C 53	13975.	13975.	13975.	13975.	13975.	13975.	13975.	13975.
C 54	13538.	13838.	13538.	13838.	13538.	13838.	13538.	13838.
C 55	13100.	13100.	13100.	13100.	13100.	13100.	13100.	13100.
C 56	12725.	12725.	12725.	12725.	12725.	12725.	12725.	12725.
C 57	12363.	12363.	12363.	12363.	12363.	12363.	12363.	12363.
C 58	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.
C 59	11688.	11688.	11688.	11688.	11688.	11688.	11688.	11688.
C 60	11325.	11325.	11325.	11325.	11325.	11325.	11325.	11325.
C 61	11050.	11050.	11050.	11050.	11050.	11050.	11050.	11050.
C 62	10750.	10750.	10750.	10750.	10750.	10750.	10750.	10750.
C 63	10488.	10488.	10488.	10488.	10488.	10488.	10488.	10488.
C 64	10225.	10225.	10225.	10225.	10225.	10225.	10225.	10225.
C 65	9975.	9975.	9975.	9975.	9975.	9975.	9975.	9975.
C 66	9688.	9688.	9688.	9688.	9688.	9688.	9688.	9688.
C 67	9450.	9450.	9450.	9450.	9450.	9450.	9450.	9450.
C 68	9225.	9225.	9225.	9225.	9225.	9225.	9225.	9225.
C 69	8975.	8975.	8975.	8975.	8975.	8975.	8975.	8975.
C 70	8750.	8750.	8750.	8750.	8750.	8750.	8750.	8750.
C 71	8513.	8513.	8513.	8513.	8513.	8513.	8513.	8513.
C 72	8300.	8300.	8300.	8300.	8300.	8300.	8300.	8300.
C 73	8100.	8100.	8100.	8100.	8100.	8100.	8100.	8100.
C 74	7950.	7950.	7950.	7950.	7950.	7950.	7950.	7950.
C 75	7738.	7738.	7738.	7738.	7738.	7738.	7738.	7738.
C 76	7525.	7525.	7525.	7525.	7525.	7525.	7525.	7525.
C 77	7450.	7450.	7450.	7450.	7450.	7450.	7450.	7450.
C 78	7225.	7225.	7225.	7225.	7225.	7225.	7225.	7225.
C 79	7063.	7063.	7063.	7063.	7063.	7063.	7063.	7063.
C 80	6963.	6963.	6963.	6963.	6963.	6963.	6963.	6963.
C 81	6763.	6763.	6763.	6763.	6763.	6763.	6763.	6763.
C 82	6638.	6638.	6638.	6638.	6638.	6638.	6638.	6638.
C 83	6488.	6488.	6488.	6488.	6488.	6488.	6488.	6488.
C 84	6350.	6350.	6350.	6350.	6350.	6350.	6350.	6350.
C 85	6250.	6250.	6250.	6250.	6250.	6250.	6250.	6250.
C 86	6100.	6100.	6100.	6100.	6100.	6100.	6100.	6100.
C 87	5988.	5988.	5988.	5988.	5988.	5988.	5988.	5988.
C 88	5900.	5900.	5900.	5900.	5900.	5900.	5900.	5900.
C 89	5750.	5750.	5750.	5750.	5750.	5750.	5750.	5750.
C 90	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 91	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 92	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 93	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 94	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 95	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 96	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 97	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 98	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C 99	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.
C100	5650.	5650.	5650.	5650.	5650.	5650.	5650.	5650.

Table 5

Accurate Masses for Aromatic Hydrocarbons

C No.	Z=6	Z=8	Z=10	Z=12	Z=14	Z=16	Z=18	Z=20	Z=22	Z=24	Z=26	Z=28
C 6	78.0469											
C 7	92.0626											
C 8	106.0782	104.0626										
C 9	120.0939	118.0782	116.0626	128.0626								
C 10	134.1095	132.0939	130.0782	142.0939	154.0782	152.0626						
C 11	148.1252	146.1095	144.0939	156.0939	168.0939	166.0782						
C 12	162.1408	160.1252	158.1095	170.1095	182.1095	180.0939						
C 13	176.1565	174.1408	172.1272	184.1252	196.1252	194.1095	178.0782					
C 14	190.1721	188.1565	186.1408	198.1408	210.1408	208.1252	192.0939	190.0782				
C 15	204.1878	202.1721	200.1565	212.1565	224.1565	222.1408	206.1095	204.0939	202.0782			
C 16	218.2034	216.1878	214.1721	226.1721	238.1721	236.1565	220.1252	218.1095	216.0939	228.0939	226.0782	
C 17	232.2191	230.2034	228.1878	240.1878	252.1878	250.1721	248.1565	246.1408	244.1252	242.1095	240.0939	252.0939
C 18	246.2347	244.2191	242.2034	268.2191	280.2191	278.2034	262.1721	260.1565	258.1408	256.1252	254.1095	266.1095
C 19	260.2504	258.2347	256.2191	282.2347	304.2347	302.2191	286.1721	284.1565	282.1408	280.1252	278.1095	288.1252
C 20	274.2660	272.2504	270.2347	298.2504	320.2504	318.2347	302.2034	300.1878	298.1721	296.1565	294.1408	304.1408
C 21	288.2817	286.2660	284.2504	308.2660	330.2660	328.2504	312.2191	310.1878	308.1721	306.1565	304.1408	314.1408
C 22	302.2973	300.2817	298.2660	322.2817	344.2817	342.2660	326.2347	324.2191	322.2034	320.1878	318.1721	328.1721
C 23	316.3130	314.2973	312.2817	334.2973	356.2973	354.2817	338.2504	336.2347	334.2191	332.2034	330.1878	340.1878
C 24	330.3286	328.3130	326.2973	348.2973	370.2973	368.2817	352.2504	350.2347	348.2191	346.2034	344.1878	354.1878
C 25	344.3443	342.3286	340.3130	362.3286	384.3286	382.3130	366.2817	364.2660	362.2504	360.2347	358.2191	368.2191
C 26	358.3599	356.3443	354.3286	376.3443	398.3443	396.3286	380.3000	378.2844	376.2688	374.2532	372.2376	382.2376
C 27	372.3756	370.3599	368.3443	390.3599	412.3599	410.3443	394.3130	392.2973	390.2817	388.2660	386.2504	394.2504
C 28	386.3912	384.3756	382.3599	404.3756	426.3756	424.3599	408.3286	406.3130	404.2973	402.2817	400.2660	408.2660
C 29	400.4069	398.3912	396.3756	418.3912	440.3912	438.3756	422.3443	420.3286	418.3130	416.2973	414.2817	422.2817
C 30	414.4225	412.4069	410.3912	432.4069	454.4069	452.3912	436.3599	434.3443	432.3286	430.3130	428.2973	436.2973
C 31	428.4382	426.4225	424.4069	446.4069	468.4069	466.3912	450.3599	448.3443	446.3286	444.3130	442.2973	450.2973
C 32	442.4538	440.4382	438.4225	460.4225	482.4225	480.4069	464.3756	462.3599	460.3443	458.3286	456.3130	464.3130
C 33	456.4695	454.4538	452.4382	474.4382	496.4382	494.4225	478.3912	476.3756	474.3599	472.3443	470.3286	478.3286
C 34	470.4851	468.4695	466.4538	488.4538	510.4538	508.4382	492.4069	490.3912	488.3756	486.3599	484.3443	492.3443
C 35	484.5008	482.4851	480.4695	502.4695	524.4695	522.4538	506.4225	504.4069	502.3912	500.3756	498.3599	506.3599
C 36	498.5164	496.5008	494.4851	516.4851	538.4851	536.4695	520.4382	518.4225	516.4069	514.3912	512.3756	520.3756
C 37	512.5321	510.5164	508.5008	530.5008	552.5008	550.4851	534.4538	532.4382	530.4225	528.4069	526.3912	534.3912
C 38	526.5477	524.5321	522.5164	544.5164	566.5164	564.5008	548.4695	546.4538	544.4382	542.4225	540.4069	548.4069
C 39	540.5634	538.5477	536.5321	558.5321	580.5321	578.5164	562.4851	560.4695	558.4538	556.4382	554.4225	562.4225
C 40	554.5790	552.5634	550.5477	572.5477	594.5477	592.5321	576.5008	574.4851	572.4695	570.4538	568.4382	576.4382
C 41	568.5947	566.5790	564.5634	586.5634	608.5634	606.5477	590.5164	588.5008	586.4851	584.4695	582.4538	590.4538
C 42	582.6103	580.5947	578.5790	600.5790	622.5790	620.5634	604.5321	602.5164	600.5008	598.4851	596.4695	604.4695
C 43	596.6260	594.6103	592.5947	614.5947	636.5947	634.5790	618.5477	616.5321	614.5164	612.5008	610.4851	618.4851
C 44	610.6416	608.6260	606.6103	628.6103	650.6103	648.5947	632.5634	630.5477	628.5321	626.5164	624.5008	632.5008
C 45	624.6573	622.6416	620.6260	642.6260	664.6260	662.6103	646.5790	644.5634	642.5477	640.5321	638.5164	646.5164
C 46	638.6729	636.6573	634.6416	656.6416	678.6416	676.6260	660.5947	658.5790	656.5634	654.5477	652.5321	660.5321
C 47	652.6886	650.6729	648.6573	670.6573	692.6573	690.6416	674.6103	672.5947	670.5790	668.5634	666.5477	674.5477
C 48	666.7042	664.6886	662.6729	684.6729	706.6729	704.6573	688.6260	686.6103	684.5947	682.5790	680.5634	688.5634
C 49	680.7199	678.7042	676.6886	698.6886	720.6886	718.6729	702.6416	700.6260	698.6103	696.5947	694.5790	702.5790
C 50	694.7355	692.7199	690.7042	712.7042	734.7042	732.6886	716.6573	714.6416	712.6260	710.6103	708.5947	716.5947

Table 5 (continued)
Accurate Masses for Aromatic Hydrocarbons

C No.	Z=30	Z=32	Z=34	Z=36	Z=38	Z=40	Z=42	Z=44	Z=46	Z=48	Z=50	Z=52
C 6	250.0782											
C 7	264.0939											
C 8	278.1095											
C 9	292.1252	276.0939										
C 10	306.1408	304.1252	302.1095	300.0939								
C 11	320.1565	318.1408	316.1252	314.1095								
C 12	334.1721	332.1565	330.1408	328.1252	326.1095	324.0939						
C 13	348.1878	346.1721	344.1565	342.1408	340.1252	338.1095	336.0939					
C 14	362.2034	360.1878	358.1721	356.1565	354.1408	352.1252	350.1095					
C 15	376.2191	374.2034	372.1878	370.1721	368.1565	366.1408	364.1252	362.1095				
C 16	390.2347	388.2191	386.2034	384.1878	382.1721	380.1565	378.1408	376.1252	374.1095	372.0939		
C 17	404.2504	402.2347	400.2191	398.2034	396.1878	394.1721	392.1565	390.1408	388.1252	386.1095	398.1095	396.0939
C 18	418.2660	416.2504	414.2347	412.2191	410.2034	408.1878	406.1721	404.1565	402.1408	400.1252	412.1252	410.1095
C 19	432.2817	430.2660	428.2504	426.2347	424.2191	422.2034	420.1878	418.1721	416.1565	414.1408	426.1408	424.1252
C 20	446.2973	444.2817	442.2660	440.2504	438.2347	436.2191	434.2034	432.1878	430.1721	428.1565	440.1565	438.1408
C 21	460.3130	458.2973	456.2817	454.2660	452.2504	450.2347	448.2191	446.2034	444.1878	442.1721	454.1721	452.1565
C 22	474.3286	472.3130	470.2973	468.2817	466.2660	464.2504	462.2347	460.2191	458.2034	456.1878	468.1878	466.1721
C 23	488.3443	486.3286	484.3130	482.2973	480.2817	478.2660	476.2504	474.2347	472.2191	470.2034	482.2034	480.1878
C 24	502.3599	500.3443	498.3286	496.3130	494.2973	492.2817	490.2660	488.2504	486.2347	484.2191	496.2191	494.2034
C 25	516.3756	514.3599	512.3443	510.3286	508.3130	506.2973	504.2817	502.2660	500.2504	498.2347	510.2347	508.2191
C 26	530.3912	528.3756	526.3599	524.3443	522.3286	520.3130	518.2973	516.2817	514.2660	512.2504	524.2504	522.2347
C 27	544.4069	542.3912	540.3756	538.3599	536.3443	534.3286	532.3130	530.2973	528.2817	526.2660	538.2660	536.2504
C 28	558.4225	556.4069	554.3912	552.3756	550.3599	548.3443	546.3286	544.3130	542.2973	540.2817	552.2817	550.2660
C 29	572.4382	570.4225	568.4069	566.3912	564.3756	562.3599	560.3443	558.3286	556.3130	554.2973	566.2973	564.2817
C 30	586.4539	584.4382	582.4225	580.4069	578.3912	576.3756	574.3599	572.3443	570.3286	568.3130	580.3130	578.2973
C 31	600.4695	598.4539	596.4382	594.4225	592.4069	590.3912	588.3756	586.3599	584.3443	582.3286	594.3286	592.3130
C 32	614.4851	612.4695	610.4539	608.4382	606.4225	604.4069	602.3912	600.3756	598.3599	596.3443	608.3443	606.3286
C 33	628.5008	626.4851	624.4695	622.4539	620.4382	618.4225	616.4069	614.3912	612.3756	610.3599	622.3599	620.3443
C 34	642.5164	640.5008	638.4851	636.4695	634.4539	632.4382	630.4225	628.4069	626.3912	624.3756	636.3756	634.3599
C 35	656.5321	654.5164	652.5008	650.4851	648.4695	646.4539	644.4382	642.4225	640.4069	638.3912	650.3912	648.3756
C 36	670.5477	668.5321	666.5164	664.5008	662.4851	660.4695	658.4539	656.4382	654.4225	652.4069	664.4069	662.3912

Table 5 (continued)

Accurate Masses for Aromatic Hydrocarbons												
C No.	<u>Z=54</u>	<u>Z=56</u>	<u>Z=58</u>	<u>Z=60</u>	<u>Z=62</u>	<u>Z=64</u>	<u>Z=66</u>	<u>Z=68</u>	<u>Z=70</u>	<u>Z=72</u>	<u>Z=74</u>	<u>Z=76</u>
C 6												
C 7												
C 8												
C 9												
C 10												
C 11												
C 12												
C 13												
C 14												
C 15												
C 16												
C 17												
C 18												
C 19												
C 20												
C 21												
C 22												
C 23												
C 24												
C 25												
C 26												
C 27												
C 28												
C 29												
C 30												
C 31												
C 32												
C 33												
C 34	422.1095	420.0939										
C 35	436.1252	434.1095										
C 36	450.1408	448.1252	446.1095	444.0939								
C 37	464.1565	462.1408	460.1252	458.1095								
C 38	478.1721	476.1565	474.1408	472.1252	470.1095							
C 39	492.1878	490.1721	488.1565	486.1408	484.1252							
C 40	506.2034	504.1878	502.1721	500.1565	498.1408							
C 41	520.2191	518.2034	516.1878	514.1721	512.1565	496.1252	494.1095					
C 42	534.2347	532.2191	530.2034	528.1878	526.1721	510.1408	508.1252	520.1252	518.1095			
C 43	548.2504	546.2347	544.2191	542.2034	540.1878	524.1565	522.1408	534.1408	532.1252			
C 44	562.2660	560.2504	558.2347	556.2191	554.2034	538.1721	536.1565	548.1565	546.1408	544.1252		
C 45	576.2817	574.2660	572.2504	570.2347	568.2191	566.2034	564.1878	576.1878	574.1721	572.1565	570.1408	568.1252
C 46	590.2973	588.2817	586.2660	584.2504	582.2347	580.2191	578.2034	590.2034	588.1878	586.1721	584.1565	582.1408
C 47	604.3130	602.2973	600.2817	598.2660	596.2504	594.2347	592.2191	604.2191	602.2034	600.1878	598.1721	596.1565
C 48	618.3286	616.3130	614.2973	612.2817	610.2660	608.2504	606.2347	618.2347	616.2191	614.2034	612.1878	610.1721
C 49	632.3443	630.3286	628.3130	626.2973	624.2817	622.2660	620.2504	632.2504	630.2347	628.2191	626.2034	624.1878
C 50	646.3599	644.3443	642.3286	640.3130	638.2973	636.2817	634.2660					

Table 5 (continued)

Accurate Masses for Aromatic Hydrocarbons

C No.	2=6	2=8	2=10	2=12	2=14	2=16	2=18	2=20	2=22	2=24	2=26	2=28
C 51	708.7512	706.7355	704.7199	702.7042	700.6886	698.6729	696.6573	694.6416	692.6260	690.6103	688.5947	686.5790
C 52	722.7668	720.7512	718.7355	716.7199	714.7042	712.6886	710.6729	708.6573	706.6416	704.6260	702.6103	700.5947
C 53	736.7825	734.7668	732.7512	730.7355	728.7199	726.7042	724.6886	722.6729	720.6573	718.6416	716.6260	714.6103
C 54	750.7981	748.7825	746.7668	744.7512	742.7355	740.7199	738.7042	736.6886	734.6729	732.6573	730.6416	728.6260
C 55	764.8138	762.7981	760.7825	758.7668	756.7512	754.7355	752.7199	750.7042	748.6886	746.6729	744.6573	742.6416
C 56	778.8294	776.8138	774.7981	772.7825	770.7668	768.7512	766.7355	764.7199	762.7042	760.6886	758.6729	756.6573
C 57	792.8451	790.8294	788.8138	786.7981	784.7825	782.7668	780.7512	778.7355	776.7199	774.7042	772.6886	770.6729
C 58	806.8607	804.8451	802.8294	800.8138	798.7981	796.7825	794.7668	792.7512	790.7355	788.7199	786.7042	784.6886
C 59	820.8764	818.8607	816.8451	814.8294	812.8138	810.7981	808.7825	806.7668	804.7512	802.7355	800.7199	798.7042
C 60	834.8920	832.8764	830.8607	828.8451	826.8294	824.8138	822.7981	820.7825	818.7668	816.7512	814.7355	812.7199
C 61	848.9077	846.8920	844.8764	842.8607	840.8451	838.8294	836.8138	834.7981	832.7825	830.7668	828.7512	826.7355
C 62	862.9233	860.9077	858.8920	856.8764	854.8607	852.8451	850.8294	848.8138	846.7981	844.7825	842.7668	840.7512
C 63	876.9390	874.9233	872.9077	870.8920	868.8764	866.8607	864.8451	862.8294	860.8138	858.7981	856.7825	854.7668
C 64	890.9546	888.9390	886.9233	884.9077	882.8920	880.8764	878.8607	876.8451	874.8294	872.8138	870.7981	868.7825
C 65	904.9703	902.9546	900.9390	898.9233	896.9077	894.8920	892.8764	890.8607	888.8451	886.8294	884.8138	882.7981
C 66	918.9859	916.9703	914.9546	912.9390	910.9233	908.9077	906.8920	904.8764	902.8607	900.8451	898.8294	886.8138
C 67	933.0016	930.9859	928.9703	926.9546	924.9390	922.9233	920.9077	918.8920	916.8764	914.8607	912.8451	910.8294
C 68	947.0172	945.0016	942.9859	940.9703	938.9546	936.9390	934.9233	932.9077	930.8920	928.8764	926.8607	924.8451
C 69	961.0329	959.0172	957.0016	954.9859	952.9703	950.9546	948.9390	946.9233	944.9077	942.8920	940.8764	938.8607
C 70	975.0485	973.0329	971.0172	969.0016	966.9859	964.9703	962.9546	960.9390	958.9233	956.9077	954.8920	952.8764
C 71	989.0642	987.0485	985.0329	983.0172	981.0016	978.9859	976.9703	974.9546	972.9390	970.9233	968.9077	966.8920
C 72	1003.0798	1001.0642	999.0485	997.0329	995.0172	993.0016	990.9859	988.9703	986.9546	984.9390	982.9233	980.9077
C 73	1017.0955	1015.0798	1013.0642	1011.0485	1009.0329	1007.0172	1005.0016	1002.9859	1000.9703	998.9546	996.9390	994.9233
C 74	1031.1111	1029.0955	1027.0798	1025.0642	1023.0485	1021.0329	1019.0172	1017.0016	1014.9859	1012.9703	1010.9546	1008.9390
C 75	1045.1268	1043.1111	1041.0955	1039.0798	1037.0642	1035.0485	1033.0329	1031.0172	1029.0016	1026.9859	1024.9703	1022.9546
C 76	1059.1424	1057.1268	1055.1111	1053.0955	1051.0798	1049.0642	1047.0485	1045.0329	1043.0172	1041.0016	1038.9859	1036.9703
C 77	1073.1581	1071.1424	1069.1268	1067.1111	1065.0955	1063.0798	1061.0642	1059.0485	1057.0329	1055.0172	1053.0016	1050.9859
C 78	1087.1737	1085.1581	1083.1424	1081.1268	1079.1111	1077.0955	1075.0798	1073.0642	1071.0485	1069.0329	1067.0172	1065.0016
C 79	1101.1894	1099.1737	1097.1581	1095.1424	1093.1268	1091.1111	1089.0955	1087.0798	1085.0642	1083.0485	1081.0329	1079.0172
C 80	1115.2050	1113.1894	1111.1737	1109.1581	1107.1424	1105.1268	1103.1111	1101.0955	1099.0798	1097.0642	1095.0485	1093.0329
C 81	1129.2207	1127.2050	1125.1894	1123.1737	1121.1581	1119.1424	1117.1268	1115.1111	1113.0955	1111.0798	1109.0642	1107.0485
C 82	1143.2363	1141.2207	1139.2050	1137.1894	1135.1737	1133.1581	1131.1424	1129.1268	1127.1111	1125.0955	1123.0798	1121.0642
C 83	1157.2520	1155.2363	1153.2207	1151.2050	1149.1894	1147.1737	1145.1581	1143.1424	1141.1268	1139.1111	1137.0955	1135.0798
C 84	1171.2676	1169.2520	1167.2363	1165.2207	1163.2050	1161.1894	1159.1737	1157.1581	1155.1424	1153.1268	1151.1111	1149.0955
C 85	1185.2833	1183.2676	1181.2520	1179.2363	1177.2207	1175.2050	1173.1894	1171.1737	1169.1581	1167.1424	1165.1268	1163.1111
C 86	1199.2989	1197.2833	1195.2676	1193.2520	1191.2363	1189.2207	1187.2050	1185.1894	1183.1737	1181.1581	1179.1424	1177.1268
C 87	1213.3146	1211.2989	1209.2833	1207.2676	1205.2520	1203.2363	1201.2207	1199.2050	1197.1894	1195.1737	1193.1581	1191.1424
C 88	1227.3302	1225.3146	1223.2989	1221.2833	1219.2676	1217.2520	1215.2363	1213.2207	1211.2050	1209.1894	1207.1737	1205.1581
C 89	1241.3459	1239.3302	1237.3146	1235.2989	1233.2833	1231.2676	1229.2520	1227.2363	1225.2207	1223.2050	1221.1894	1219.1737
C 90	1255.3615	1253.3459	1251.3302	1249.3146	1247.2989	1245.2833	1243.2676	1241.2520	1239.2363	1237.2207	1235.2050	1233.1894
C 91	1269.3772	1267.3615	1265.3459	1263.3302	1261.3146	1259.2989	1257.2833	1255.2676	1253.2520	1251.2363	1249.2207	1247.2050
C 92	1283.3928	1281.3772	1279.3615	1277.3459	1275.3302	1273.3146	1271.2989	1269.2833	1267.2676	1265.2520	1263.2363	1261.2207
C 93	1297.4085	1295.3928	1293.3772	1291.3615	1289.3459	1287.3302	1285.3146	1283.2989	1281.2833	1279.2676	1277.2520	1275.2363
C 94	1311.4241	1309.4085	1307.3928	1305.3772	1303.3615	1301.3459	1299.3302	1297.3146	1295.2989	1293.2833	1291.2676	1289.2520
C 95	1325.4398	1323.4241	1321.4085	1319.3928	1317.3772	1315.3615	1313.3459	1311.3302	1309.3146	1307.2989	1305.2833	1303.2676
C 96	1339.4554	1337.4398	1335.4241	1333.4085	1331.3928	1329.3772	1327.3615	1325.3459	1323.3302	1321.3146	1319.2989	1317.2833
C 97	1353.4711	1351.4554	1349.4398	1347.4241	1345.4085	1343.3928	1341.3772	1339.3615	1337.3459	1335.3302	1333.3146	1331.2989
C 98	1367.4867	1365.4711	1363.4554	1361.4398	1359.4241	1357.4085	1355.3928	1353.3772	1351.3615	1349.3459	1347.3302	1345.3146
C 99	1381.5024	1379.4867	1377.4711	1375.4554	1373.4398	1371.4241	1369.4085	1367.3928	1365.3772	1363.3615	1361.3459	1359.3302
C100	1395.5180	1393.5024	1391.4867	1389.4711	1387.4554	1385.4398	1383.4241	1381.4085	1379.3928	1377.3772	1375.3615	1373.3459

Table 5 (continued)
Accurate Masses for Aromatic Hydrocarbons

C No.	Z=30	Z=32	Z=34	Z=36	Z=38	Z=40	Z=42	Z=44	Z=46	Z=48	Z=50	Z=52
C 51	684.5634	682.5477	680.5321	678.5164	676.5008	674.4851	672.4695	670.4538	668.4382	666.4225	664.4069	662.3912
C 52	698.5790	696.5634	694.5477	692.5321	690.5164	688.5008	686.4851	684.4695	682.4538	680.4382	678.4225	676.4069
C 53	712.5947	710.5790	708.5634	706.5477	704.5321	702.5164	700.5008	698.4851	696.4695	694.4538	692.4382	690.4225
C 54	726.6103	724.5947	722.5790	720.5634	718.5477	716.5321	714.5164	712.5008	710.4851	708.4695	706.4538	704.4382
C 55	740.6260	738.6103	736.5947	734.5790	732.5634	730.5477	728.5321	726.5164	724.5008	722.4851	720.4695	718.4538
C 56	754.6416	752.6260	750.6103	748.5947	746.5790	744.5634	742.5477	740.5321	738.5164	736.5008	734.4851	732.4695
C 57	768.6573	766.6416	764.6260	762.6103	760.5947	758.5790	756.5634	754.5477	752.5321	750.5164	748.5008	746.4851
C 58	782.6729	780.6573	778.6416	776.6260	774.6103	772.5947	770.5790	768.5634	766.5477	764.5321	762.5164	760.5008
C 59	796.6886	794.6729	792.6573	790.6416	788.6260	786.6103	784.5947	782.5790	780.5634	778.5477	776.5321	774.5164
C 60	810.7042	808.6886	806.6729	804.6573	802.6416	800.6260	798.6103	796.5947	794.5790	792.5634	790.5477	788.5321
C 61	824.7199	822.7042	820.6886	818.6729	816.6573	814.6416	812.6260	810.6103	808.5947	806.5790	804.5634	802.5477
C 62	838.7355	836.7199	834.7042	832.6886	830.6729	828.6573	826.6416	824.6260	822.6103	820.5947	818.5790	816.5634
C 63	852.7512	850.7355	848.7199	846.7042	844.6886	842.6729	840.6573	838.6416	836.6260	834.6103	832.5947	830.5790
C 64	866.7668	864.7512	862.7355	860.7199	858.7042	856.6886	854.6729	852.6573	850.6416	848.6260	846.6103	844.5947
C 65	880.7825	878.7668	876.7512	874.7355	872.7199	870.7042	868.6886	866.6729	864.6573	862.6416	860.6260	858.6103
C 66	894.7981	892.7825	890.7668	888.7512	886.7355	884.7199	882.7042	880.6886	878.6729	876.6573	874.6416	872.6260
C 67	908.8138	906.7981	904.7825	902.7668	900.7512	898.7355	896.7199	894.7042	892.6886	890.6729	888.6573	886.6416
C 68	922.8294	920.8138	918.7981	916.7825	914.7668	912.7512	910.7355	908.7199	906.7042	904.6886	902.6729	900.6573
C 69	936.8451	934.8294	932.8138	930.7981	928.7825	926.7668	924.7512	922.7355	920.7199	918.7042	916.6886	914.6729
C 70	950.8607	948.8451	946.8294	944.8138	942.7981	940.7825	938.7668	936.7512	934.7355	932.7199	930.7042	928.6886
C 71	964.8764	962.8607	960.8451	958.8294	956.8138	954.7981	952.7825	950.7668	948.7512	946.7355	944.7199	942.7042
C 72	978.8920	976.8764	974.8607	972.8451	970.8294	968.8138	966.7981	964.7825	962.7668	960.7512	958.7355	956.7199
C 73	992.9077	990.8920	988.8764	986.8607	984.8451	982.8294	980.8138	978.7981	976.7825	974.7668	972.7512	970.7355
C 74	1006.9233	1004.9077	1002.8920	1000.8764	998.8607	996.8451	994.8294	992.8138	990.7981	988.7825	986.7668	984.7512
C 75	1020.9390	1018.9233	1016.9077	1014.8920	1012.8764	1010.8607	1008.8451	1006.8294	1004.8138	1002.7981	1000.7825	998.7668
C 76	1034.9546	1032.9390	1030.9233	1028.9077	1026.8920	1024.8764	1022.8607	1020.8451	1018.8294	1016.8138	1014.7981	1012.7825
C 77	1048.9703	1046.9546	1044.9390	1042.9233	1040.9077	1038.8920	1036.8764	1034.8607	1032.8451	1030.8294	1028.8138	1026.7981
C 78	1062.9859	1060.9703	1058.9546	1056.9390	1054.9233	1052.9077	1050.8920	1048.8764	1046.8607	1044.8451	1042.8294	1040.8138
C 79	1077.0016	1074.9859	1072.9703	1070.9546	1068.9390	1066.9233	1064.9077	1062.8920	1060.8764	1058.8607	1056.8451	1054.8294
C 80	1091.0172	1089.0016	1086.9859	1084.9703	1082.9546	1080.9390	1078.9233	1076.9077	1074.8920	1072.8764	1070.8607	1068.8451
C 81	1105.0329	1103.0172	1101.0016	1098.9859	1096.9703	1094.9546	1092.9390	1090.9233	1088.9077	1086.8920	1084.8764	1082.8607
C 82	1119.0485	1117.0329	1115.0172	1113.0016	1110.9859	1108.9703	1106.9546	1104.9390	1102.9233	1100.9077	1098.8920	1096.8764
C 83	1133.0642	1131.0485	1129.0329	1127.0172	1125.0016	1122.9859	1120.9703	1118.9546	1116.9390	1114.9233	1112.9077	1110.8920
C 84	1147.0798	1145.0642	1143.0485	1141.0329	1139.0172	1137.0016	1134.9859	1132.9703	1130.9546	1128.9390	1126.9233	1124.9077
C 85	1161.0955	1159.0798	1157.0642	1155.0485	1153.0329	1151.0172	1149.0016	1146.9859	1144.9703	1142.9546	1140.9390	1138.9233
C 86	1175.1111	1173.0955	1171.0798	1169.0642	1167.0485	1165.0329	1163.0172	1161.0016	1158.9859	1156.9703	1154.9546	1152.9390
C 87	1189.1268	1187.1111	1185.0955	1183.0798	1181.0642	1179.0485	1177.0329	1175.0172	1173.0016	1170.9859	1168.9703	1166.9546
C 88	1203.1424	1201.1268	1199.1111	1197.0955	1195.0798	1193.0642	1191.0485	1189.0329	1187.0172	1185.0016	1182.9859	1180.9703
C 89	1217.1581	1215.1424	1213.1268	1211.1111	1209.0955	1207.0798	1205.0642	1203.0485	1201.0329	1199.0172	1197.0016	1194.9859
C 90	1231.1737	1229.1581	1227.1424	1225.1268	1223.1111	1221.0955	1219.0798	1217.0642	1215.0485	1213.0329	1211.0172	1209.0016
C 91	1245.1894	1243.1737	1241.1581	1239.1424	1237.1268	1235.1111	1233.0955	1231.0798	1229.0642	1227.0485	1225.0329	1223.0172
C 92	1259.2050	1257.1894	1255.1737	1253.1581	1251.1424	1249.1268	1247.1111	1245.0955	1243.0798	1241.0642	1239.0485	1237.0329
C 93	1273.2207	1271.2050	1269.1894	1267.1737	1265.1581	1263.1424	1261.1268	1259.1111	1257.0955	1255.0798	1253.0642	1251.0485
C 94	1287.2363	1285.2207	1283.2050	1281.1894	1279.1737	1277.1581	1275.1424	1273.1268	1271.1111	1269.0955	1267.0798	1265.0642
C 95	1301.2520	1299.2363	1297.2207	1295.2050	1293.1894	1291.1737	1289.1581	1287.1424	1285.1268	1283.1111	1281.0955	1279.0798
C 96	1315.2676	1313.2520	1311.2363	1309.2207	1307.2050	1305.1894	1303.1737	1301.1581	1299.1424	1297.1268	1295.1111	1293.0955
C 97	1329.2833	1327.2676	1325.2520	1323.2363	1321.2207	1319.2050	1317.1894	1315.1737	1313.1581	1311.1424	1309.1268	1307.1111
C 98	1343.2989	1341.2833	1339.2676	1337.2520	1335.2363	1333.2207	1331.2050	1329.1894	1327.1737	1325.1581	1323.1424	1321.1268
C 99	1357.3146	1355.2989	1353.2833	1351.2676	1349.2520	1347.2363	1345.2207	1343.2050	1341.1894	1339.1737	1337.1581	1335.1424
C100	1371.3302	1369.3146	1367.2989	1365.2833	1363.2676	1361.2520	1359.2363	1357.2207	1355.2050	1353.1894	1351.1737	1349.1581

Accurate Masses for Aromatic Hydrocarbons

C. No.	Z=54	Z=56	Z=58	Z=60	Z=62	Z=64	Z=66	Z=68	Z=70	Z=72	Z=74	Z=76
C 51	660.3756	658.3599	656.3443	654.3286	652.3130	650.2973	648.2817	646.2660	644.2504	642.2347	640.2191	638.2034
C 52	674.3912	672.3756	670.3599	668.3443	666.3286	664.3130	662.2973	660.2817	658.2660	656.2504	654.2347	652.2191
C 53	688.4069	686.3912	684.3756	682.3599	680.3443	678.3286	676.3130	674.2973	672.2817	670.2660	668.2504	666.2347
C 54	702.4225	700.4069	698.3912	696.3756	694.3599	692.3443	690.3286	688.3130	686.2973	684.2817	682.2660	680.2504
C 55	716.4382	714.4225	712.4069	710.3912	708.3756	706.3599	704.3443	702.3286	700.3130	698.2973	696.2817	694.2660
C 56	730.4538	728.4382	726.4225	724.4069	722.3912	720.3756	718.3599	716.3443	714.3286	712.3130	710.2973	708.2817
C 57	744.4695	742.4538	740.4382	738.4225	736.4069	734.3912	732.3756	730.3599	728.3443	726.3286	724.3130	722.2973
C 58	758.4851	756.4695	754.4538	752.4382	750.4225	748.4069	746.3912	744.3756	742.3599	740.3443	738.3286	736.3130
C 59	772.5008	770.4851	768.4695	766.4538	764.4382	762.4225	760.4069	758.3912	756.3756	754.3599	752.3443	750.3286
C 60	786.5164	784.5008	782.4851	780.4695	778.4538	776.4382	774.4225	772.4069	770.3912	768.3756	766.3599	764.3443
C 61	800.5321	798.5164	796.5008	794.4851	792.4695	790.4538	788.4382	786.4225	784.4069	782.3912	780.3756	778.3599
C 62	814.5477	812.5321	810.5164	808.5008	806.4851	804.4695	802.4538	800.4382	798.4225	796.4069	794.3912	792.3756
C 63	828.5634	826.5477	824.5321	822.5164	820.5008	818.4851	816.4695	814.4538	812.4382	810.4225	808.4069	806.3912
C 64	842.5790	840.5634	838.5477	836.5321	834.5164	832.5008	830.4851	828.4695	826.4538	824.4382	822.4225	820.4069
C 65	856.5947	854.5790	852.5634	850.5477	848.5321	846.5164	844.5008	842.4851	840.4695	838.4538	836.4382	834.4225
C 66	870.6103	868.5947	866.5790	864.5634	862.5477	860.5321	858.5164	856.5008	854.4851	852.4695	850.4538	848.4382
C 67	884.6260	882.6103	880.5947	878.5790	876.5634	874.5477	872.5321	870.5164	868.5008	866.4851	864.4695	862.4538
C 68	898.6416	896.6260	894.6103	892.5947	890.5790	888.5634	886.5477	884.5321	882.5164	880.5008	878.4851	876.4695
C 69	912.6573	910.6416	908.6260	906.6103	904.5947	902.5790	900.5634	898.5477	896.5321	894.5164	892.5008	890.4851
C 70	926.6729	924.6573	922.6416	920.6260	918.6103	916.5947	914.5790	912.5634	910.5477	908.5321	906.5164	904.5008
C 71	940.6886	938.6729	936.6573	934.6416	932.6260	930.6103	928.5947	926.5790	924.5634	922.5477	920.5321	918.5164
C 72	954.7042	952.6886	950.6729	948.6573	946.6416	944.6260	942.6103	940.5947	938.5790	936.5634	934.5477	932.5321
C 73	968.7199	966.7042	964.6886	962.6729	960.6573	958.6416	956.6260	954.6103	952.5947	950.5790	948.5634	946.5477
C 74	982.7355	980.7199	978.7042	976.6886	974.6729	972.6573	970.6416	968.6260	966.6103	964.5947	962.5790	960.5634
C 75	996.7512	994.7355	992.7199	990.7042	988.6886	986.6729	984.6573	982.6416	980.6260	978.6103	976.5947	974.5790
C 76	1010.7668	1008.7512	1006.7355	1004.7199	1002.7042	1000.6886	998.6729	996.6573	994.6416	992.6260	990.6103	988.5947
C 77	1024.7825	1022.7668	1020.7512	1018.7355	1016.7199	1014.7042	1012.6886	1010.6729	1008.6573	1006.6416	1004.6260	1002.6103
C 78	1038.7981	1036.7825	1034.7668	1032.7512	1030.7355	1028.7199	1026.7042	1024.6886	1022.6729	1020.6573	1018.6416	1016.6260
C 79	1052.8138	1050.7981	1048.7825	1046.7668	1044.7512	1042.7355	1040.7199	1038.7042	1036.6886	1034.6729	1032.6573	1030.6416
C 80	1066.8294	1064.8138	1062.7981	1060.7825	1058.7668	1056.7512	1054.7355	1052.7199	1050.7042	1048.6886	1046.6729	1044.6573
C 81	1080.8451	1078.8294	1076.8138	1074.7981	1072.7825	1070.7668	1068.7512	1066.7355	1064.7199	1062.7042	1060.6886	1058.6729
C 82	1094.8607	1092.8451	1090.8294	1088.8138	1086.7981	1084.7825	1082.7668	1080.7512	1078.7355	1076.7199	1074.7042	1072.6886
C 83	1108.8764	1106.8607	1104.8451	1102.8294	1100.8138	1098.7981	1096.7825	1094.7668	1092.7512	1090.7355	1088.7199	1086.7042
C 84	1122.8920	1120.8764	1118.8607	1116.8451	1114.8294	1112.8138	1110.7981	1108.7825	1106.7668	1104.7512	1102.7355	1100.7199
C 85	1136.9077	1134.8920	1132.8764	1130.8607	1128.8451	1126.8294	1124.8138	1122.7981	1120.7825	1118.7668	1116.7512	1114.7355
C 86	1150.9233	1148.9077	1146.8920	1144.8764	1142.8607	1140.8451	1138.8294	1136.8138	1134.7981	1132.7825	1130.7668	1128.7512
C 87	1164.9390	1162.9233	1160.9077	1158.8920	1156.8764	1154.8607	1152.8451	1150.8294	1148.8138	1146.7981	1144.7825	1142.7668
C 88	1178.9546	1176.9390	1174.9233	1172.9077	1170.8920	1168.8764	1166.8607	1164.8451	1162.8294	1160.8138	1158.7981	1156.7825
C 89	1192.9703	1190.9546	1188.9390	1186.9233	1184.9077	1182.8920	1180.8764	1178.8607	1176.8451	1174.8294	1172.8138	1170.7981
C 90	1206.9859	1204.9703	1202.9546	1200.9390	1198.9233	1196.9077	1194.8920	1192.8764	1190.8607	1188.8451	1186.8294	1184.8138
C 91	1221.0016	1218.9859	1216.9703	1214.9546	1212.9390	1210.9233	1208.9077	1206.8920	1204.8764	1202.8607	1200.8451	1198.8294
C 92	1235.0172	1233.0016	1230.9859	1228.9703	1226.9546	1224.9390	1222.9233	1220.9077	1218.8920	1216.8764	1214.8607	1212.8451
C 93	1249.0329	1247.0172	1245.0016	1242.9859	1240.9703	1238.9546	1236.9390	1234.9233	1232.9077	1230.8920	1228.8764	1226.8607
C 94	1263.0485	1261.0329	1259.0172	1257.0016	1254.9859	1252.9703	1250.9546	1248.9390	1246.9233	1244.9077	1242.8920	1240.8764
C 95	1277.0642	1275.0485	1273.0329	1271.0172	1269.0016	1266.9859	1264.9703	1262.9546	1260.9390	1258.9233	1256.9077	1254.8920
C 96	1291.0798	1289.0642	1287.0485	1285.0329	1283.0172	1281.0016	1278.9859	1276.9703	1274.9546	1272.9390	1270.9233	1268.9077
C 97	1305.0955	1303.0798	1301.0642	1299.0485	1297.0329	1295.0172	1293.0016	1290.9859	1288.9703	1286.9546	1284.9390	1282.9233
C 98	1319.1111	1317.0955	1315.0798	1313.0642	1311.0485	1309.0329	1307.0172	1305.0016	1302.9859	1300.9703	1298.9546	1296.9390
C 99	1333.1268	1331.1111	1329.0955	1327.0798	1325.0642	1323.0485	1321.0329	1319.0172	1317.0016	1314.9859	1312.9703	1310.9546
C 100	1347.1424	1345.1268	1343.1111	1341.0955	1339.0798	1337.0642	1335.0485	1333.0329	1331.0172	1329.0016	1326.9859	1324.9703